# Science Education

*Formerly* GENERAL SCIENCE QUARTERLY

**Devoted to the Teaching of Science in Elementary Schools, Junior and Senior High Schools, Colleges and Teacher Training Institutions**

**Volume 25** **MARCH, 1941** **Number 3**

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PUBLISHED BY
SCIENCE EDUCATION, INCORPORATED

Communications regarding manuscripts should be sent to the Editor, Science Education, 374 Broadway, Albany, N. Y., or 32 Washington Place, New York City. Major articles should be no longer than 3,000 words; classroom notes should be limited to 500 words. "Suggestions to Authors" will be sent upon request.

Correspondence regarding advertising, subscriptions and business matters should be addressed to the Business Manager, Science Education, College Station, Stillwater, Oklahoma. The subscription price is $2.50 a year; $3.50 in Canada and other foreign countries. Single copies are 50 cents; 65 cents in foreign countries. Prices on back numbers will be sent on request. Prices on reprints of articles are available to authors.

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# Science Education

## SPECIAL ISSUE ON ELEMENTARY SCIENCE

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## CONSERVATION COMES TO THE ELEMENTARY SCHOOLS

NELLIE M. FIELDS

*Principal, Clinton School, Minneapolis, Minn.*

The school curriculums for centuries have provided an opportunity for children to learn of the natural resources of their country.

As glibly as the grandmothers of the past sang the states and their capitols, so children of a decade ago lipped off the states that were champions in grain raising, mineral production, or mining. That corn-producing areas were being wrecked by erosion, that grazing lands were being ruthlessly upturned to wind and weed destruction, that wild life was being sacrificed needlessly, failed to flag the attention of curriculum makers of the day just past.

Now conservation has come into the elementary schools. There wasn't much time to discuss criteria or technique when it came. Should conservation be taught as a separate subject? Should it be set up as a program or a project? Should it be allowed to drift in the class room incidentally? These were the questions that required time and experience to meet and no one knew the answers. One question persisted. Can conservation be kept out of the public schools? The children answered this question and answered it with finality and enthusiasm. They reported conservation projects. They brought pictures of windbreaks and flood areas.

Human beings do not spring to the solution of adult problems. They are getting ready for them all the way up.

The child in the elementary school writing about a walk in the school yard in spring was learning the multiplication of conservation as he wrote:

> "The water was running off the school ground. It left ditches. It did not run fast around the shrubs and trees. Yesterday the little streams were carrying sand; today I saw rocks in them."

This childish report laid bare the grave problem of soil erosion and hinted at its correction.

Land use came in in another form in the sixth grade. "More top soil washes from a field of corn in the south than in the north." A child made this statement in class; another child challenged it. The doubtful child had driven along the highways in the country. He had seen gully washes in the field, and he knew what it meant.

Before the question was settled to the satisfaction of the class, they knew that there was such a thing as "robber crops." They knew that Minnesota farmers had reason to be glad for the long winters and frozen ground that could not be washed away easily. They listed the crops of north and south. They contrasted short-root

crops with crops that left stubble in the field—"soil holders" they called them. They brought pictures of contour farming. They drew pictures of "circular farming in a square field." Government bulletins supplemented their social science textbooks and gave them a new type of reading lesson.

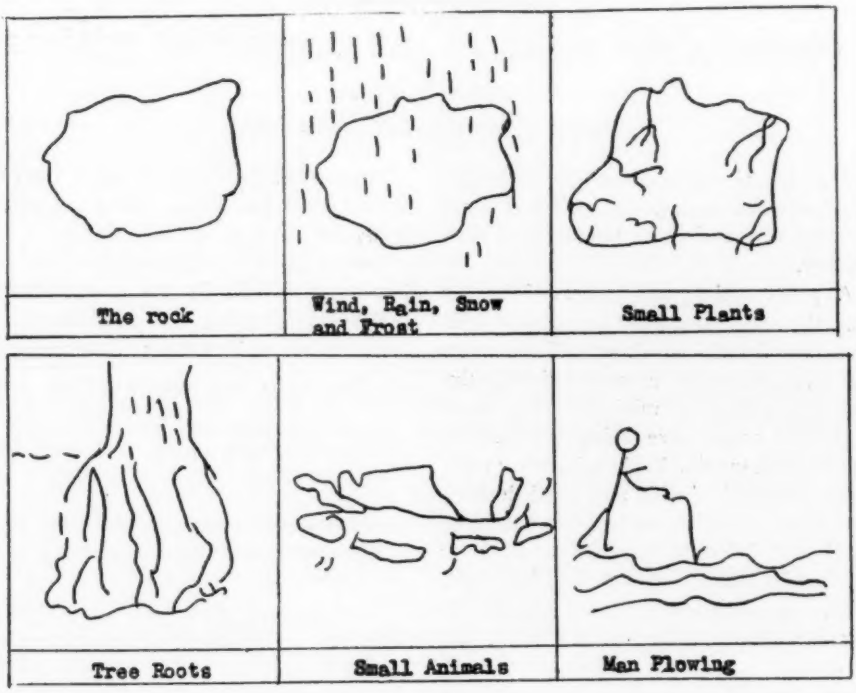
Someone asked the question "How is soil made?" Maybe it was the teacher. Who cares if she didn't answer it? A committee of children went after the answer. They didn't know that they were facing the second great problem of soil conservation —soil restoration. They only knew they were having a good time. They were quite unaware that they were learning functional English when they wrote to the adviser in Science, the State Conservation department, and a geologist for information or a request to talk to them.

The members of the committee expressed their findings in different ways. Here is one:

*How Soil is Made*

Soil is made from rocks, decayed animals and plants. Nature's tools, to mention a few, are sunshine, wind, rain, and frost. After these wear the rock soft, tiny plants dig their roots into the crevices in the rock. After them larger plants, even trees, wind themselves around the rocks. After the plants and trees do their work, the ants, earthworms and small burrowing animals set to work. These small animals and insects till the soil to a much greater depth than the plow made by man. It takes from four hundred years up to make one inch of soil. One child answered the question this way.

THE MAKING OF SOIL




Children in another school carried on an experiment in soils, an experiment that took them on excursions to Minnehaha Creek many times. They came back with interesting observations and a vocabulary that included "run off," "spill ways," "corrective work," "springy," and "spongy ground." They came back with more, a

desire to test the "erosiveness" of six different types of soils. This they did in the school room.

The teacher reports: "When the experiment was over they saw that the finest and richest top soil was most easily eroded." The question "How can the farmer check erosion?" naturally followed this experiment. They demonstrated contour farming, terracing, and strip cropping on a sand table and concluded their study by planting corn, oats, and alfalfa to illustrate rotation of crops. Week end trips resulted in many reports. Here are two of them:

"Patsy and I rode out in the country to look for ways people were conserving soil. I had told Daddy all about our study of conservation so we all looked for places like we had studied about. We found only one hill that had contour plowing. All the rest had up and down plowing."

"Last week-end we went to Iron Mountain, Minnesota. I saw a wide and long gully near the bottom of a hill. Bushes had been planted to stop erosion, but they weren't very big yet."

It is not all preaching and no practising in these conservation minded classes. One class could not rotate crops to prove their belief in soil rotation, but they could try fertilization in the school room. A child brought some commercial fertilizer. As a result, the leaves of the ivy plant changed from fading yellow to green.

A pheasant feather in the cap of a third grade child brought into the class room an interest that no one wished to rule out. It was hunting season and even the first grade children writing single sentences to tell "Home News" responded:

"Hunting season is here."
"I like pheasants."
"Fathers cannot play with guns in the house."

And another one:

"My Daddy likes to hunt."
"Men shoot ducks and deers and pheasants."

The fifth and sixth grade took a deeper interest. As the hunting season opened they knew the day and the hour; they knew the limit. They examined hunting licenses. They knew the hunting regulations of their own state. They extolled the law abiding hunter as they did the farmer who left clumps of wood and vines in the corners of the fields to shelter the pheasants.

Much sentimentality about hunting has been avoided. These children know that destruction of wild life is necessary for the perpetuation of wild life.

The "humps and bumps" in the boggy land along the Minnesota River bottom attracted the attention of children riding along the highway overlooking it. One fourth grade class now knows that these are more than "humps and bumps"; they are the homes of musk rats.

Some points of similarity may have led to the beaver. For more knowledge of the beaver than they had, a group of children wrote letters to the national and state conservation departments for government bulletins. One letter was addressed to a city fur company, another one to The National Life Trap Company. Brief stories or paragraphs gave authenticated information on many subjects including:

The History of the Beaver
The Beaver House
The Beavers' Tail
Beaver Kits
Beaver Store Houses
Beaver Dams

"The study took care of all my language work," the teacher reported.

A school excursion to the Museum of Natural History acquainted a sixth grade group of children with the Beltrami Project. It came about through curiosity about the caribou exhibit in the museum. An illustrated article in the Sunday paper gave further impetus to a study of the Beltrami and Pine Island Projects in Minnesota. From their own research in libraries, government bulletins, and replies to letters, they have found answers to many questions. A group report follows:

"This is the largest wild life refuge in America.

Every species of wild life native to Minnesota can be found in this refuge.

The only herd of caribou in the United States is here."

The report is no longer leading into the history of the area and its unfitness for farming. A subtle bit of teaching, the way of a Democracy, was this teacher's opportunity. An article on the library table told of controversies over the wisest use of this 1,640,000 acres of land, this Big Bog. Should the farmers be moved and established in more productive areas? How should this be done? How should the wild life be restored? Reporting on this article the chairman of the children's committee said:

"It is right for people and organizations to tell what they think should be done and in the end the Conservation Department talks over all their suggestions, then makes rules and plans that seem best for all."

The co-operation of government offices, wild life organizations, and individuals have greatly furthered the work of conservation in the elementary schools. Pamphlets have been supplied in great numbers. Speakers have come at the request of children and no letter has seemed too unimportant to answer. This point needs no emphasis. If it did, it is here.

A "Grade Y" hike led past a lake within the city limits. The boys discovered several steel traps buried in the grass near the shore. This fact was brought up in a Civic League meeting in school the next morning. The class voted to instruct the room secretary to write to the Board of Park Commissioners reporting this. The Park Board did not take a report from sixth grade children too lightly. The park commissioner replied:

BOARD OF PARK COMMISSIONERS
April 23, 1940

Children of Room 203
Grade 6A, ..... School
....., .....

Dear Boys and Girls:

"Your nice letter of April 22 in reference to the traps you discovered in the brush near Lake Harriet while out on a Grade Y hike, has been received, and I wish to assure you that this matter will have our immediate attention.

We appreciate your calling our attention to this illegal trapping on park property, and have issued instructions to both our police and maintenance divisions to watch out for this practice at the location mentioned and not only remove any traps found there but be on the watch for offenders.

Thank you for your interest in the protection and preservation of wild life and for calling our attention to this infringement."

Very truly yours,
BOARD OF PARK COMMISSIONERS,
..... (Signed)
*Superintendent of Parks*

# DEVELOPING THE PROGRAM OF CONSERVATION EDUCATION IN OHIO *

OLLIE E. FINK

*Curriculum Supervisor, Conservation Education*
*Department of Education, State of Ohio*

In presenting a program for Ohio or any other state, it is well to look at the position that the state holds in the national picture. I believe it was Kipling who expressed the need of a survey of the whole in order to compare and understand its parts when he said, "What should they know of England, who only England knows?"

Let's make a hasty survey of our nation. An air traveler flying west from here would see a living map. Geography at 200 miles per hour would make sense out of meaningless statistics. He sees how the land lies. He sees it roll up into the bumpy Appalachians. Ohio shows the influence of the surveying system with its familiar quarter sections. These checkerboard spacing of farms continue a monotonous march on through Kansas. There, the corn gives way to wheat. Vegetation must be adjusted to fit into the prevailing climatic conditions. Nature carries on a program

* Presented to the National Council on Elementary Science, Atlantic City Meeting, February 22, 1941.

of conservation determined by the climax vegetation. The land is rising and climaxes with the mountain slopes and peaks. A most important physical fact is that over ninety per cent of the nation has a slope of two per cent or over, a fact which makes man responsible for determining whether the raindrop is a friend or an enemy.

In the east, we saw winding roads curving back and forth between towns. The towns seem surprisingly far apart. In the central states the roads straighten out and crossings are at right angles. In the western mountains again, we see the road winding back and forth. When the air traveler sees the highways below converging to some central point, he can look for a settlement. Cities do not just happen. They develop at the cross roads, at the mouth of a river, at the head of the valley, and especially where the type of transportation changes.

Three migration waves have helped to populate this nation; the British in the 17th century; the Scotch, the Irish, and the Germans in the 18th century; and the Slavs and the Italians in the 19th. The population of this land has grown from about 300,000 original Indians to over 130,000,000 inhabitants. These migration waves have not provided a solution to the population pressure on the land in the countries of Europe. The population of Europe has increased about three-fold since Ohio was first settled. Their standard of living has not increased in proportion to the great increase in the United States. This leads to the present defense needs.

We, as elementary teachers in the science area should be interested in the causes underlying the great difference in the living standards of the various regions of the world. The application of science and invention provides the key to these differences.

Let us study the application of some of the early inventions. In Ohio and other eastern regions of our nation, the frontier was conquered with great hardship and hazard through the use of the axe, rifle, boat, and horse. It is important to realize that a region when occupied by a people is influenced by the cultural heritage of the settlers. This culture includes the knowledge and belief based upon experience and tradition, as well as upon available scientific and technological equipment. Of equal importance is the fact that the people in turn are affected by the physical characteristics of the land.

To the Ohio pioneer, the wilderness land as it was found had little economic value. In order to turn it into productive capital, the forests must be turned into fields. This process required labor — human energy. After the trees were burned, the stumps and roots still remained. These must be removed before the land could be efficiently plowed. Fences must be built to protect the small but valuable crop area from the stock. They soon discovered that when stock was exposed to the severe cold, it required more food. As a result, barns were soon constructed. Nature does not compromise. Many cattle would die in the spring for want of provisions, especially when the grass was delayed.

The pioneer spent two centuries learning to partially adjust his life to this humid environment. Many of his methods were unsuited to the new environment. His failure to live in harmony with the new environment has resulted in our conservation problems of today. The science teacher should follow with interest the advance of the pioneer from one environment into another seeking the wealth of the soil, the forests and the minerals. He moved from the forest lands westward into the grasslands. Here he found the axe of little use. However, three other important inventions made it possible to again establish a home. Probably most teachers would not guess what these inventions were. They were the windmill, the barbed wire fence, and the six shooter. The change into the plains and its new environment is clearly

expressed in the following quotation from *The Great Plains* by Webb:

> As one contrasts the civilization of the Great Plains with that of the eastern timberland, one sees what may be called an institutional fault (comparable to a geological fault) running from midde Texas to Illinois or Dakota roughly following the 98th meridian. At this fault, the ways of life and of living change. Practically every institution that was carried across it was either broken and remade or else greatly altered. The ways of travel, the weapons, the method of tilling the soil, the plows and other agricultural implements, and even the laws themselves were modified. When people first crossed this line they did not immediately realize the imperceptible change that had taken place in their environment, nor, more is the tragedy, did they foresee the full consequences which that change was to bring in their own characters and in their modes of life. In the new region—level, timberless, and semi-arid—they were thrown by Mother Necessity into the clutch of new circumstances. Their plight has been stated in this way: east of the Mississippi civilization stood on three legs—land, water, and timber; west of the Mississippi not one but two of these legs were withdrawn—water and timber—and civilization was left on one leg—land. It is small wonder that it toppled over in temporary failure.[1]

The facts which have been presented demonstrate the need for the population of any particular region to understand their environment. The illustration which my friend, J. Russell Smith, often uses is very appropriate. Recently at the Conservation Education Conference of the A.A.A.S. in Philadelphia, he said:

> At the present time I often think of the Beaver as symbolic of the transfer to America of the European population. Somebody sent a Beaver from Canada to the office of the Head of the Hudson Bay Company in London, who thought he would make a nice pet. This little fellow played around the office like a pet dog for a few weeks, but there came a time that something suggested to him to make a dam. He proceeded one night to take all of the chairs and desks and chew them apart and skillfully arrange them and in the morning he was found waiting on the top of his new dam for the water to come in.
>
> That was a transfer of a technique to the wrong environment. And I am wondering if such a transfer of effort has not been taking place in this country. It was an easy transfer from the land of Europe to the land of America, the climate suited the European. They could transfer the animals that they could bring along, and they could transfer the cabbages, the carrots for the garden, and bring along wheat and barley and clover for the fields—all their major crops came but we demonstrated our devilish lack of adjustability when we got to corn and later on to cotton and tobacco. And here they came with the European concept of plowing ground, and they added to the concept of plowing the ground the cultivation of the crop. The soil was ripped loose several times a year.*

Perhaps many teachers have not understood why the Ohio Valley was settled so rapidly. The Eastern settlers had failed to understand their environment, and therefore they had destroyed it. The policy of the frontiersman was to "skin the land" and to move to a "succeeding West" and get another farm. "Go West" was their answer. Let us look at a statement of the first American soil scientist and his description of conditions in eastern Virginia:

> Travelers and natives alike in this period (1815–1830) agree on the impression that an angel of desolation had cursed the land, many tracts presenting scenes of ruin that baffle description—farm after farm . . . worn out, washed and gullied, so that scarcely an acre could be found in a place fit for cultivation; dreary and uncultivated wastes, a barren and exhausted soil, half clothed Negroes, lean and hungry stock, a puny race of horses, a scarcity of provender, houses falling to decay, and fences windshaken and dilapidated.
>
> Meanwhile an emigrating contagion resembling an epidemic disease had seized the people. Thousands . . . in the hopelessness of bettering their condition in their native land abandoned the beloved homes of their nativity.
>
> There was scarcely a proprietor in my neighborhood . . . who did not desire to sell his land, and who was prevented only by the impossibility of finding a purchaser, unless at half of the then very low estimated value. All wished to sell, none to buy. And what was true of lower Virginia applied with equal force to the older portions of Maryland and the Carolinas. The prospects for a young planter were indeed, gloomy.[2]

[1] Webb, W. B. *The Great Plains.* Boston: Ginn and Company.

*Mimeographed report of this conference will be issued by Ohio Division of Conservation and Natural Resources in cooperation with National Wildlife Federation.

[2] See *Fertilizer Review,* November and December, 1938, for an article on "Edmund Ruffin, Southerner" by Cravens.

The nation is big. Abe Lincoln said to a heckler, "We'll give you a farm—the United States has a farm for everyone." Farms were given away fifty years after Lincoln's death. Some of us in this audience remember the opening of Oklahoma for settlement (1907). An examination of an erosion map of the nation shows this state representing the last frontier to be settled with the worst experience of any state.

Man has not yet learned to understand his environment and to live there happily and usefully. The "move to a new farm" period is gone. Land hunger is as keen as ever but land is scarce. Probably not more than one acre out of five on the globe is arable land. In the United States not more than one acre out of three can ever be farmed even under the utmost pressure. Much of this soil is worn and hurt. Statisticians figure that two and one-half acres is needed to supply the farm products one individual uses per year. Yes, we are already feeling the shortage of usable soil. We have ruined by soil erosion an area equal to the combined acreage of New York, Pennsylvania, Vermont, New Hampshire, Massachusetts, Connecticut, Rhode Island, New Jersey, Delaware, and Maryland. In the nation, the average top soil was originally about nine inches, today it is only five. Uncle Sam's good earth—his rich top soil, that is—is the most valuable thing he owns.

We have used science to aid in exploiting our resources. We have been a manufacturing nation about fifty years. However, we have pursued an economy of "boom and bust" since the invention of the cotton gin. The combination of science, great resources, and business management has resulted in our nation having nearly fifty per cent of the world's productive income. We, with six per cent of the world's population and about six per cent of the land area of the globe, have developed a production and wealth which closely matches that of ninety-four per cent of the world's population. In giving an inventory of our nation, we use the terms "more" and "best." We have more schools, more modern homes, more telephones, more radios, more automobiles, more clothing, more airliners, more railroads, and so the list continues. We have the best scientists, the best doctors, the best chemists, the best engineers, many of the best painters and musicians, and other artisans.

The importance of science should be more important when we study the influence of invention upon our environment. We have mentioned barbed wire, and the six shooter. The list is endless. During the 1930's, the number of patents approached one-half million. Teachers in certain areas of our nation should receive additional inspiration in their science teaching when they realize that the prosperity of a region is roughly proportionate to the number of patents taken up in that area. Furthermore, many of our most important inventions were made by young men, men under 26 years of age. The old frontier was in new land. Our generations to come must find opportunities in the "frontiers of science."

In 1941, we are the richest country in the world, and yet there are probably nine million unemployed and it is estimated that forty-five million do not get enough to eat. We have ghost towns, the tombstones at the location of exploited resources of coal, textiles, copper, steel, silver, wheat, and lumber. "Forestry, a Permanent Agriculture," a bulletin recently issued by the U. S. Forest Service, reports that in one cut-over area, seven-room, modern steam-heated homes were offered for sale at $35.00 each—there were no buyers. Is our American dream being shattered? Each of us would like to leave to our children a country better than we found it—a more popular statement of this dream is to give our children more advantages than we have had. A century ago a man was frugal that

he might enable his son to be a land owner. Too often, we have thought of providing an education for our children, believing this would guarantee opportunities. Let us define education.

Education is a preparation which helps man to understand his environment and to continue to live there happily and usefully. I like this definition and my definition for Conservation Education is made simply by adding conservation to the beginning of the above definition. "Conservation education prepares a man to understand his environment and to live there happily and usefully."

What is it that makes a permanent country? What is it we are preparing to defend in this national defense program? The analysis given by J. Russell Smith, of Columbia University, at a recent meeting strikes at the heart of the problem. He said:

> What is important? We talk about saving Democracy. How much Democracy is there one mile off the coast of Atlantic City or on a piece of cut-over and burned-over Wisconsin timberland, or on a square mile of gullied and abandoned farmland in the South. The answer is there isn't any. Democracy has to have a basis; people have to have a basis. It is important to save Democracy and human stock, but after all, a human stock may go, but if the land stays, another human stock may come—but the basis of everything is that we must save the land. One of the primary jobs, one of the principal jobs of the educator is to prepare the people to adjust themselves to the environment in which they live.

Conservation education deals with all resources, but in the final analysis, soil, water, and plants provide the triangular base for the only permanent civilization. When man understands, and through science adapts his life to the proper functioning of this triangle, he has a "fountain of energy" which provides his needs and maintains the life of every living thing. Chlorophyll in the plant may be compared to blood in the animal. Life is "broadcast" over the green network. When this green network is worn thin, life becomes a struggle. The air traveler is amazed at the frequency of the great scars—gullies—which he observes. The green network is worn thin and destroyed. It is not the purpose of this paper to give a statistical analysis. It has been estimated that it would require a train of freight cars long enough to girdle the earth eighteen times at the equator to carry three billion tons of soil washed out of the fields and pastures each year by water erosion alone. To correct this problem, there is work to be done. One estimate is 1,600 million man-days for conservation.

Our schools are interested in maintaining democracy. Let me remind you again of Dr. Smith's statement above that when there is no basis—land—there isn't any democracy. A prophet of our times, Paul Sears, dramatically tells the story of what is happening to our soil in his book, *Deserts on the March*. We must teach man to understand his environment. When the soil goes, democracy goes, and democracy is going in certain areas. I was recently surprised when George Phillips, Chairman of the Farm Forest Committee of the United States Department of Agriculture, stated the attitudes and reactions of the farmers in the western plains. He said "Some have even voted to dissolve their county government as an economy measure."

Perhaps conservation is to take its place as one of the cornerstones of our democracy. Louis Bromfield, the internationally known author, and a practical farmer as well, has issued this statement for us:

> "In my opinion, the Conservation Program is the most important undertaking in American history since the founding of the Nation and the preservation of the Union. It represents the preservation and creation of almost incalculable treasures both spiritual and material for the nation."*

How long we have slept. Patrick Henry is said to have remarked "Since the achievement of our independence, he is the greatest patriot, who stops the most gullies."

The conservation teacher is of greater

* Quoted from a letter by Louis Bromfield.

importance than the soldier in achieving democracy. Before closing, I do want to briefly review our Ohio program. This paper no doubt has failed to present what many of those here today anticipated. Perhaps you were expecting a discourse on methods and activities. Instead of the "how" and "when" and "where," I have tried to give the "why." A school room in Ohio has this motto, "Strive to know why, for this teaches how and when."

Conservation Education will be included as a major concept in the revised elementary curriculum in Ohio. Curriculum building requires careful planning. The building of this curriculum may be compared to the Boy Scouts making their way to camp at night. They saw the glow of the campfire in the distance across the lake. This gave them a beacon light—pointed the direction. Still they used their flashlights for each individual step. Without the "beacon light" (campfire) they might have lost their way. Without the flashlights they most certainly would have stumbled over many obstructions to their progress. Progress in conservation is so urgent that we must plan the way—we must not leave this to chance. We begin with the first grade with our plans. Each grade advances from the foundation of understanding established in the preceding units. "On the spot" planning may not assure progress toward the "conservation way of living." Conservation Units are to be built to a completed plan just as the stones are cut to fit the architect's specifications in the blueprint. The stones are not cut at random—they are cut according to their place in the blueprint. Units carefully planned should have sequence and depth. A great choice of activities, "flashlight steps" will provide the opportunity for each teacher to travel paths according to her creative interest — provided she guides the class toward the goal—"the conservation way of living."

In the development of our new educational program, we must be concerned about "teaching the teacher" and teaching the pupil. Our program of "teaching the teacher" is divided into three phases; literature for the teacher, conservation laboratory for teacher training, and assistance in the development of programs for teacher training institutions. We have issued a teacher's manual on conservation, "The Teacher Looks at Conservation." It provides a background of information prepared to develop broad conservation attitudes. It also contains a variety of activities which should result in progress in our Conservation Education program.

Our Conservation laboratory was inaugurated last June and will be continued this summer. This laboratory school in the forest has received the highest praise from many of our national leaders in education and conservation. The staff represents the four aspects of knowledge having to do most directly with conservation. These are earth science, botany, zoology, and social science. But instead of the usual separate teaching of these as distinct subjects every effort has been made to use them as points of view dealing with one common problem—conservation. Rather than a deep and scientific study of any particular phase of life, the aim is to give the teacher an understanding of the interrelatedness of soils, plants and the varieties of life existing in the environment, interpreting the resulting changes in our social and economic conditions as affected by changes in the landscape such as may be represented by droughts, floods, and erosion. This program has been supplemented by a varied array of special speakers representing different phases of the many practical angles of conservation. In every respect the experiment seems to be unique and worthy of widespread adoption.

In the elementary school, our primary emphasis will be on the science principles. In the secondary schools, our attention will be given to the social and economic impli-

cations of the interrelated conservation problems.

Let us illustrate how interrelated the ecological and geographical problems are. In a water planning program, we begin with the raindrop. The child in the primary school can understand the principles of elementary science. A speaker at the recent science meetings remarked that the "kindergarden child is as great a scientist as any." The uncontrolled raindrop runs downhill. This principle leads to an understanding of streams and rivers and their watershed. Let us not overlook the fact that the invisible part of the watershed may be the most important—the atmosphere and its raindrops. Within the framework of watershed, we study flood control, soil surface preservation, power and navigation, pollution, recreation, water supply, and many other social and economic problems.

We have seen how a watershed study may have many interrelated and complementary problems. Those of us living in an areal laboratory must use the techniques of several sciences and social science, in order to understand the region. Let us think of these influences as a series of enormous spider webs—several layers of webs, one upon another. One web or more may cover only the watershed. Other webs may cover a small section while still larger ones may cross several watersheds. In our regional study, we need to analyze the influence of such "webs" as physiographic areas, land and water, forests, minerals, flora and crops, types of farming areas, argicultural adjustments, industrial activities, transportation influences, commercial and trade advantages, governmental service, metropolitan, literary, newspaper and other cultural influences. In learning to live in his environment we see a variety of influences which must be analyzed before man understands and can adapt his living to a permanent and enduring nation. Each of these "webs" and many others has an influence upon our conservation problems. Society can work out an enduring balance by planning for human welfare and permanent economic development.

In the elementary school, we think of conservation as a part of the program of every teacher and in every subject. Conservation is not to be added to the overcrowded curriculum as a new subject. The responsibility is too great to be assumed by one teacher. Ohio is now outlining a program of elementary science units, the first conservation teaching materials which we plan to issue will be included as a major concept in these science units.

Our plans are in the formation stage. We are planning the "blueprints." Sequence and depth, we believe, may be developed through a series of units such as the following suggestive list:

**First grade: How do plants look in the fall?**
**Second grade: How do we use plants?**
**Third grade: How do living things grow?**
**Fourth grade: In what ways can trees be protected?**
**Fifth grade: How are plants and animals interdependent?**
**Sixth grade: Do you live at the top of a water pyramid?**

For those who are interested in "how," may I call your attention to the activities suggested in some inexpensive bulletins recently issued by the U. S. Office of Education, such as *Teaching Conservation in Elementary Schools, Curriculum Content in Conservation for Elementary Schools,* and *Conservation Excursions.* Also may I suggest that our publication *The Teacher Looks at Conservation* has a wealth of suggestions on "why" "how" "when" and "where." In closing, I would like to state that this Ohio program is made possible through the cooperation of the Division of Conservation and Natural Resources and the State Department of Education. Ohio State University was also a cooperative agency in our Conservation Laboratory.

# CONSERVATION EDUCATION AND THE ELEMENTARY SCHOOL

E. LAURENCE PALMER
*Cornell University*

Twenty-one years ago, I wrote my first article on Conservation Education. It was published in the *Nature Study Review*.[1] That article emphasized the value of nature-study in the teaching of conservation and patriotism. Written at the close of World War I, it has some suggestions possibly pertinent to World War II.

There seems to be a revival of interest in conservation on an effective wide-spread basis if we can accept as evidence the fact that the term conservation is being used generally and with pride by those interested in the problems of economics, of soil, of wildlife, of forests, of minerals and of human resources. Were the idea not sound and had it not won general public approval, it is doubtful if the word would be used so freely by so many groups as a key word to designate the nature of their organizations. Has the idea back of this movement found satisfactory expression in the elementary schools or is much that is appearing under this name at these levels merely "the same old stuff" wrapped up in a new package in the hope it will find popularity there?

Because of the limitations of space and for other reasons, conservation here will be concerned more particularly with its applications to problems of wildlife management. A well-financed movement to introduce conservation widely into the elementary schools is being sponsored by the National Wildlife Federation. Few phases of work new to most schools have had better backing than is now being given this work. What are the possibilities of its success? What should elementary schools do about the opportunities offered? Since the writer has figured in no way in the preparation of this new program, he feels free to comment on it. It seems only fair that every opportunity should be extended to give the program a fair trial, that schools should use the material provided them and help the committee by reporting the results to the end that improvement may be provided.

The writer's comment on possible pitfalls of Conservation Education published a year ago[2] does not seem to have been heeded in the new proposals since most of the rich materials developed by those interested in wildlife management have found no place in the new offering. The whole field of wildlife management is growing so rapidly that it is not surprising that its pioneer discoveries are unknown to the average science teacher. Not one of the 905 members of the Wildlife Society appears on the committee responsible for this new program and yet the journal of that society bristles with material easily adapted with profit and often with little modification for use at elementary levels.

The role of predators such as the owls, weasels, hawks, foxes and cats commonly misunderstood by most people; the relationship between cover and abundance; the problems surrounding startling decreases in numbers of fur-bearers often trapped by elementary school youngsters; the relationships between woodchuck holes and rabbits in summer and winter; the role of junk piles in providing cover for game; the role

[1] Palmer, E. Laurence. "How the Cornell Rural School Leaflet Hopes to Teach Conservation Through Nature-Study." *Nature-Study Review* 16: 65–72; February, 1920.

[2] Palmer, E. Laurence. "Conservation Education in the Schools." *School Science and Mathematics* 40: 226–237; March, 1940.

of shrubby fencerows as against clean fencerows; the role of tall seed-bearing weeds in providing food for winter residents are a few of the fields abundantly covered in the literature of the practical wildlife manager but apparently neglected or inadequately treated in these new offerings which will be vigorously pushed this year. To get this practical slant on things, teachers would do well to get the news sheets released by such states as Pennsylvania, Iowa, Ohio and Louisiana or by such government agencies as the Soil Conservation Service and the National Park Service. Children can hardly be expected to make a satisfactory application of the sound principles developed as abstract biology to the wildlife of their neighborhood.

Possibly a good way to illustrate how impractical may be the suggestions of a science supervisor would be to quote some wildlife units appearing comparatively recently in a published doctor's thesis dealing with science in the elementary school. In this thesis, we find a test in which elementary children are asked to decide whether a pheasant is an insect-eater, a seed eater or a game bird; to decide whether birds die or go South in winter and whether it is harmful or injurious when one insect eats another. Forgetting the absurdity of these questions as units of measurement of mastery of science concepts, we must recognize the futility of such techniques to develop a practical understanding of wildlife problems. Incidentally, this study was voted as being of outstanding merit by members of the National Association for Research in Science Teaching. I doubt if it would win equal distinction if examined by practical students of natural history. It is to be hoped that even though this sort of thing seems to have masqueraded successfully as science, it cannot win approval cloaked as conservation.

There are so many things which little children can *do* to help improve the prosperity of local wildlife that it seems as though any offering for these children should be virile with practical activities. Planting of slips of food-bearing shrubs where they may help game and prevent soil erosion; sowing seeds of the right kinds of weeds on bare ground on hikes; controlling the activities of local cats; studying the plants on the school lawn which provide seeds for sparrows; mapping the school or home lawns to find which areas produce the largest number of night crawlers and potential lunches for game birds; noticing from tracks in winter snow the relationship between the presence of brush land and the abundance of rabbits and pheasants; learning of how surplus rabbits and pheasants are trapped in city parks, golf links and cemeteries by boys cooperating with the State authorities to assist in populating hunting areas outside the cities; having juvenile fishermen begin to keep records of the "kind" of water and the weather conditions which accompany good catches of trout; beginning to explore snowbanks with thermometers, with mimiature snow fences and with spring balances to understand how they affect quail, pheasants and rabbits are a few of the fields which should offer fruitful types of activity for elementary school children at least in the upper grades. True, most of these ideas are well-known to the average game manager but for the most part they do not appear in school programs either under the title of science or of conservation. Obviously they are tied with each.

It would seem as though conservation in the elementary school bears somewhat the same relationship to science that work in health, in gardening, in agriculture and in home making does. Science should form a basis for profitable activities in all of these fields but it does not always do this. Of course, conservation is as closely tied with social science as it is with natural science. This means that the one teaching conservation must be more than a scientist and must

have some understanding of science in its broader applications. Possibly conservation may form a cardinal principle of education in addition to those long recognized as important. In fact, in a recent revision of this list of principles, conservation finds a new place for itself and a new dignity not formerly accorded it by educators. Possibly, in these new plans calling for reorganization of school offerings, conservation may, because of its wide significance in different fields, find much greater recognition for itself than ever before. Should such a shift come, there will of course be a wild scramble for a prominent seat on the band wagon.

An examination of the offerings in Conservation Education for elementary schools finds a varied treatment. The types of organization include those planned around systematic units, around scientific principles, around ecological units and around concepts of social science.

Outlines planned around systematic units recognize merit in studying mammals, birds, insects, plants, rocks, minerals, soils and so on. This seems to be the commonest type of organization at present. It is well presented in programs from such widely separated states as Pennsylvania, Arizona, Florida and Wisconsin. Good materials here are found in publications from Texas, New Mexico, Ohio, Kansas, Michigan and Ohio and Illinois.

Outlines planned around such scientific principles as those involved in protection, the tropisms, ancestry, cycles and migration seem to be best represented in the offerings of Tennessee, West Virginia, Kansas, Missouri and possibly Ohio.

Outlines planned around ecological units are too few and too inadequately developed to warrant emphasis here. The social science concept of conservation which includes adequate recognition of the role of natural science finds best expression probably in the offerings from Tennessee, Wisconsin, West Virginia, Texas, Kansas and possibly Ohio. The writer made a more adequate survey of this situation and published abstracts of the material in publications by the American Nature Association.[3] These were based on studies made by graduate students under grants from the American Nature Association.[4-9] These studies are being continued with special consideration of the effectiveness of various methods of education.

These studies have shown wide variation in proposals for grade placement of materials. They emphasize the need of sequential proposals in the different fields where the succeeding proposals call for greater ability and where they use previously presented material. If one should suggest 2-grade levels for the twelve years of pre-college work, these might involve the following steps.

First level. Grades 1 and 2 or for beginners in any grade. Exploration. Use of senses. Getting the raw facts. Recognition of major factors.

Second 2-grade level. Correlation of experiences but still depending essentially

[3] Palmer, E. Laurence. "Conservation Problems in the Schools." *Quarterly Bulletin American Nature Association* 1: 1–30; October, 1938, and "Conservation Education in the Schools." *Nature Magazine* 32: 509–516; November, 1939.

[4] Young, Claiborne H. "A Report on Some of the Private Agencies Contributing to Conservation Education in North America." Master's Thesis, Cornell University, 1937. 336 p.

[5] Arnold, John R. "A Report of the State-supported Agencies, Other Than Schools, Concerned in the Conservation of Natural Resources." Ph.D. Minor Thesis, Cornell University, 1938. 538 p.

[6] Weaver, Richard L. "A Survey of Federal and National Youth Organizations Concerned in Conservation Education." Ph.D. Thesis, Cornell University, 1938. 522 p.

[7] Quaintance, Charles W. "Conservation Education in the Schools and Colleges of the United States." Ph.D. Thesis, Cornell University, 1939. 500 p.

[8] Vessel, Matt F. "A study of the Needs of Rural Agencies in Conservation Education." Ph.D. Thesis, Cornell University, 1940. 522 p.

[9] Jack, Homer A. "A Study of the Biological Field Stations of the World" (emphasis on role in Conservation Education). Ph.D. Thesis, Cornell University, 1940. 1001 p.

on the authority of the learner's senses and intelligence.

Third 2-grade level. Evaluation of experiences of others in terms of the learner's own experiences and further personal enrichment. This includes broadening the geographical horizon.

Fourth 2-grade level (the junior high levels). Adjustment of personal habits particularly to the needs of society.

Fifth 2-grade level. Recognition of the place of conservation in a world society and developing some worthy personal interest intensively.

Sixth 2-grade level. Recognition of the vocational opportunities offered directly or indirectly in the field.

The writer has attempted to put these recommendations into practice in various numbers of the *Cornell Rural School Leaflet*. This build-up of activities of different grades was possibly best developed by the author in the leaflet on "Conservation" [10] which is no longer available for distribution. It was further developed for consideration of soil problems [11] and still later with emphasis on wildlife.[12] Since the natural development of the conservation idea must include conservation of human resources, this has been done.[13] Numbers listed under [12] and [13] are still available for distribution from Cornell. They will be followed in 1941–42 by numbers dealing with conservation of inorganic resources.

[10] Palmer, E. Laurence. "Conservation." *Cornell Rural School Leaflet*, January, 1936. Volume 39, Number 3. 32 p.

[11] Palmer, E. Laurence. "Save the Soil." *Cornell Rural School Leaflet*, March, 1936. Volume 39, Number 4. 32 p.

[12] Palmer, E. Laurence. "Farm-Forest Facts," "Fields in Winter" and "Waterways in Spring." *Cornell Rural School Leaflet*, November, 1939 and January and March, 1940. Volume 33, Numbers 2 to 4. 32 pages each.

[13] Palmer, E. Laurence. "The Finer Side of Life," "You" and "Outdoor Living." *Cornell Rural School Leaflet*, November, 1940 and January and March, 1941. Volume 34, Numbers 2 to 4. 32 pages each.

It would seem that with the powerful Wildlife Federation back of a well-financed publicity drive to put conservation into the schools, with extensive studies made of this work on a world-wide basis and with a long-time emphasis on the subject by state publications in New York and elsewhere that some satisfactory progress should be made. All that can be asked of elementary teachers is that they give the offerings from these different sources a fair trial remembering of course that the subject is rapidly growing and that it will call for an understanding of many problems which were not even considered during the period of training of most teachers now in service.

It is essential to sound defense that the fundamentals of conservation which call for wise use be understood by all. Significant beginnings may be made at the elementary levels but this will call for conservation as an activity not as conversation between teacher and pupil or between pupil and book. It will call for emphasis on problems that are here and now not on what happened years ago. It will deal with things about which we can and should do something not about those things of the past about which, like spilled milk, we can only cry. Most of all it will call for keeping one's feet on the ground not going off on the tangent and accepting the repetition of high sounding generalizations as evidence that satisfactory progress has been made. Of what advantage would it be to get a thousand answers to the question, "When one insect eats another is it harmful or injurious?" if we don't first have some understanding of the value of the insect eaten? Let's not go off on that angle in Conservation Education as we have in Science Education. Let's look to the practical conservationists for some real help. They have much that they can give us who work in education. Really, we don't know it all, even though we may try to make some people think we do, and sometimes seem to succeed.

# MISTAKES ABOUT SNAKES

G. E. S. TORDT

*Director of the Biological Research Laboratories*
*Springfield, Missouri*

Three and one-half years ago the Biological Research Laboratories were founded at Springfield, Missouri. The organization was established for two purposes; to supply biological material and to continue research that had its start several years before. The research work is primarily concerned with diseases of amphibians and reptiles.

At the present a collectors' organization is associated with the Laboratories with a membership well over five hundred. These persons are part-time workers scattered throughout the country. During the spring, summer, and fall, hundreds of specimens of frogs, turtles, lizards, and snakes are sent to the Laboratories. These shipments naturally cause much speculative comment in the course of transportation and many persons ask to see the live material. They are more interested in the snakes than the other specimens. As news about the activities of the Biological Research Laboratories reached many persons by the "grape-vine telegraph," it seemed that one contribution that could easily be made would be to satisfy the curiosity and refute the common "mistakes about snakes." It was too time-consuming to answer all the inquiries by letter and conference so the Reptile Garden was established. It serves hundreds of visitors each year.

*Editor's Note:* Driving north from the South a road sign directed me to the Reptile Garden of the Biological Research Laboratories at the edge of Springfield, Missouri. I was amazed to find the most unusual garden of snakes, snakes of all kinds. The guide walks among the snakes, with just a stick in his hand, and gives demonstrations and explanations. Dr. Tordt not only directs the research work but during the winter months he lectures throughout the country. He would be very glad to hear from any of his readers.

We wish to observe our creatures in a surrounding as natural as possible and still keep the snakes and other animals captive. So a large pen was built and painted green on the inside and aluminum on the outside. In this inclosure we put all the snakes. There are trees for the arboreal snakes, pools for the water snakes, and high grass and piles of rock, logs, and burrows to contribute to a natural setting. There is water, cover, sun, plenty of shade, and very important, plenty of food! With a few exceptions, we are able to feed all varieties of snakes in the inclosure by providing white mice, sparrows, frogs, toads, and sacrificing some of our snakes to the cannibalistic varieties such as the racers and coach-whips. Some of the snakes breed in the inclosure, deposit their eggs, or bear their young alive. Frequently we have persons asks if the snakes ever escape or leave the Reptile Garden. We answer by saying that snakes are grateful for their easy life; safe, and protected from most of their enemies. Why should they wish to escape?

**ARE SNAKES BORN OR HATCHED?**

Aside from the snake pen we have a screened-in house for our lizards, a turtle run, and ponds for homes for salamanders and live frogs. All of these attractions have heightened the curiosity of the townspeople and they visit the Reptile Gardens in such numbers that it is necessary to have two guides on hand at all times.

One day a young salesman visited the Reptile Garden. He was astonished to see one of the guides in the pen with the rattlesnakes. The guide heard him tell another person standing at the fence that the fangs had been removed from the poisonous snakes. Instead of asking the observer to accept his word that the snakes had everything nature gave them, the guide picked up a white mouse and tossed it in front of the snake. Luck was with him! The rattler was hungry and excited by the action of the mouse. He struck it and within a minute or so the mouse had met a painless end. The snake then slowly devoured the mouse beginning with the head and continuing until the little white tail disappeared. Naturally there was consternation on the face of the salesman but to use an old Missouri expression, people have to be shown!

Many times we are asked the question, "Do mother snakes swallow their young in times of danger?" We have observed hundreds of snakes that have given birth to

**Do Mother Snakes Swallow Their Young?**

their young. These specimens were in captivity but the conditions were as natural as it was possible to make them. At no time have we seen a mother snake display any affection or maternal love for her young. Each baby snake must find its own food and he must eat it himself for "mother" cannot help them. Nature gives these creatures instinct concerning their enemies, food, how to hibernate, and how to hide. There is absolutely no sign of maternal guidance or training. To prove the inaneness of such a story, ask the next person who "pops the question" how he could tell a "mamma" snake from a "papa" snake. Then suggest that perhaps he had witnessed an example of canibalism.

I have had over twelve years of field work and much of my time has been devoted to collecting and observing. Never during these years have I been lucky enough to have a snake chase me. I always chase the snake! Yes many persons tramp-

**DO SNAKES CHASE PEOPLE?**

ing in the woods or getting firewood for picnics return with the "chased by a snake" episode. I do know that a snake in hiding will often come from undercover to investigate a noise. If you are tramping in the woods or field, the rustle of the underbrush and grass will reach Mr. Snake's ears and he will leave his place of abode to investigate. You can't blame him for that. He might even follow you a short distance, especially if you seem rather strange and odd. But, how quickly he will dash back into hiding if you take a step or two in his direction unless he is "cornered." That's not odd. All animals with their backs to the wall must fight!

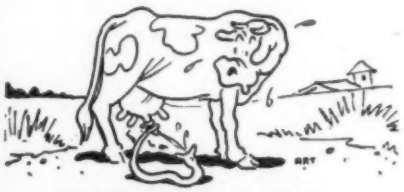
One of the most interesting questions often asked is, "Does a snake commit suicide?" I have often wondered what goes on in the mind of a snake but I have never had reason to credit the reptiles with a desire to "end it all!" My observation indicates that poisonous snakes are the only ones who might possibly entertain such a

**DO SNAKES COMMIT SUICIDE?**

notion. There are instances when a poisonous snake, just after capture, flashes out

and imbeds its fangs in the coils of its own body. Death might possibly result if the fangs happen to penetrate a vital organ of the snake but the results are not due to the poison venom or any intentions on the part of the snake to take its own life. The puncture might cause death but I am afraid that Mr. Snake would be very much chagrined.

One day a group of tourists came into the garden. One of the women had a "real" story about the snake her uncle had killed on his farm. "And do you know," she said, "my uncle quickly grabbed the axe



DO SNAKES MILK COWS?

and struck the snake and millions of gallons of milk gushed out over the floor of the barn!" Of course the luckless snake suffered the consequences of "milking" the uncle's cows but just how this feat of science occurred no one could ever tell. The time was ripe to give a demonstration of just how much milk a snake could consume under the most favorable conditions. It is better to demonstrate the fallacies of false impressions rather than explain them in so many words. This is the technique at the Reptile Gardens.

After hearing many many snake stories I got the "bug" and will tell one myself. I will tell about a friend's experience rather than one of my own just as a precaution against exaggeration.

One day, good old Charlie Becker was going to town with a load of grain. He decided to leave his farm in the early afternoon and to arrive at the edge of town by night fall. He planned to sleep in his wagon, sell his grain in the morning, and be home by noon. The road to town was not the best in the world. It was just a dirt trail over the hills but with his reliable team he could make the grade. He was driving along at a good clip when he saw a diamondback rattle-snake coiled "peacefully" in the middle of the road. The trail was too narrow to avoid the snake so Charlie had to make a quick decision. He drove his team at full speed hoping to pass the danger before the rattler "woke up." They thundered by but Mr. Rattle-snake was not so sleepy and struck like lightning. He missed all the eight legs of the horses but his fangs struck the tongue of the wagon and were deeply imbedded. The snake dangled between the galloping feet of the horses and at last the snake freed itself and shot off into the woods unharmed. Breathing hard, Charlie checked the rapid pace of the horses and drove the rest of the way more slowly. Night came and Charlie fell asleep. The next morning when he awoke he found that the tongue of the wagon was purple and swollen. The poor wagon, it was dead!

Several of my friends took this story seriously and from then on I concluded that the principle non-beliefs about snakes are truths. Serpents are a necessity. They destroy rodents and insects that are harm-

WHAT DO SNAKES EAT?

ful to man and his environment. Like all other forms of life they contribute to the balance of nature. Snakes eat frogs, but frogs also eat snakes. Snakes eat birds but some birds eat snakes. All creatures seem to be food for some other living organism. When I made that statement to a group of visitors at the Reptile Garden one afternoon one little boy piped up with the usual query, "Well, what are we food for?"

Worms, my boy, worms! They'll get you sooner or later.

# EFFECTIVE TEACHING OF SCIENCE IN THE ELEMENTARY SCHOOL

MARY MELROSE

*Supervisor of Elementary Science, Cleveland, Ohio*

There is more opportunity for effective teaching in Science than in other content subject found in the Elementary Curriculum. Let us see why this is. In the first place, it is easier to set up desirable learning situations in science because most of it is demonstrable through the use of materials. These materials are real ones instead of the make-believe ones that often must be used, for example, in arithmetic or social studies. Surely no one will deny that the easiest learning situation to develop is one that is centered around real things.

In fact, one could make a long list of phases of teaching that are "easier" in Elementary Science than in other subjects. We shall mention only a few. It is easier to stimulate and hold interest; it is easier to get active participation of pupils; and it is easier to find challenging problems. Consequently, it is easier to handle the discipline. When pupils are actively engaged in something interesting, the problem of discipline disappears. If the science teacher has not realized these things, she has not taken advantage of her opportunities.

There is more joy in good teaching than in poor teaching and many more compensations. Then why is good teaching not more universal? Naturally, every teacher wishes to do a commendable piece of work, but perhaps she has not been made aware of the factors that make for effective teaching. With help, she can learn how to analyze her work and how to plan for better classroom procedures.

One good way in which a teacher can help herself is to check her own classroom procedures objectively against a list of good ones and also against a list of poor ones. This will indicate to her the phases of teaching in which she is weak. A teacher or a group of them might also receive much benefit by making up their own check list of items found in good teaching. It is not, therefore, the purpose of this article to give a complete list, but to suggest some of the important items that might be included. The following are to be considered indicative of such items:

Signs of *Good* Science Teaching
(Partial List)

1. Teacher uses a variety of techniques, methods and procedures.
2. The class, the subject matter and the materials are well organized.
3. Teacher and pupils work together on the problem before them.
4. Children understand the reasons underlying each activity.
5. Pupils ask many questions.
6. Teacher shows respect for pupils' questions and contributions.
7. Pupils make worthwhile suggestions, devise additional experiments, and bring in specimens and materials for science.
8. Each child or group is working toward a definite goal.
9. Children read with a purpose.
10. There is much evidence in the classroom of the subject matter being studied: pictures, charts, models, specimens, etc. These often are of two types—child-made and commercial.
11. Good science teaching is full of surprises.
12. The pupils and teacher have a good time together: fun and the thrill of discovery are often present.
13. The pupils carry on science interests in out-of-school hours, such as watching animals, collecting leaves, rocks, or insects, reading about science subjects at home or at the library, starting a hobby along some phase of science.
    Note: Encouragement at home is also a factor in out-of-school science activities.

Signs of *Poor* Science Teaching
(Partial List)

1. Teacher directs everything.
2. Teacher does most of the talking.
3. Teacher asks one little question after another.
4. The class, the subject matter and the materials are not well organized.

5. Teacher carries on all the activities herself instead of letting the children grow through these experiences.
6. The same routine procedures are used day in and day out.
7. Teacher is annoyed by children's questions and their contributions, especially if they do not relate to her plan.
8. Teacher does not use materials to the best advantage, for she directs all experiments and draws the conclusions herself.
9. Teaching seems to be drudgery, and learning seems to be very hard work.
10. Children do not bring science materials to school.
11. Children are not stimulated to outside activities growing out of their school experiences in science.

Let us briefly examine the procedures in several science classes to see what signs of good teaching we shall find. On entering this science room, we noticed that the pupils were divided into groups and that each group was seated around a table. All the groups were using magnets with a great variety of materials to find what kinds of things a magnet will pick up. Interest and enthusiasm was evident in every group. Children raised questions. Some wondered why a magnet picked up certain metals and not others. Some questioned whether all magnets worked the same way. These were not satisfied until they had tried all kinds of magnets (bar, U, V, horseshoe, and cylindrical) with the various materials.

The teacher then suggested that they put all the things that a magnet would pick up in a pile and examine them to find what they were made of. While the children were busy at this, several noticed that a small object, such as a tack or paper clip, would "jump" to the magnet when it was put close by. After the children had ample time to try out all their ideas with the magnets, the teacher called them together for a conference. The children soon arrived at the generalization that a magnet will pick up things made of iron or steel.

Several pupils were eager to tell about the small objects "jumping" to the magnet. This showed, the teacher explained, that a magnet pulled iron and steel toward it. She suggested that they could find another word for pull if they read a certain page in their books. The children quickly opened their books and found the word attract. After using "attract" several times, it was added to their vocabulary list. The teacher then wrote on the blackboard—A magnet attracts iron and steel. It was evident that all understood and had a working knowledge of this generalization. The children had thoroughly enjoyed this period and showed real reluctance at leaving the room when the bell rang.

In another situation we found a fifth grade class studying the unit, What Are Things Made Of? One group of pupils was responsible for performing an experiment for the entire class. Previous to the science period, this group had read just how to do this and had all of the materials ready. One of the group told that they were going to heat some sugar in a test tube to find if the heat would cause a chemical change. Another poured a little sugar in the test tube and held it by a clamp over the hot plate. The rest of the class watched so intently that you could have heard a pin drop. When they saw the white sugar turn to a black material, they realized one of the characteristics of the sugar had been changed. The real surprise, however, came when they tasted this black material and found that it was not sweet like the sugar. Because the characteristics of the sugar had been changed in color and taste, the children decided that a chemical change had taken place.

Their curiosity was aroused! What was the black material the children asked. The group performing the experiment answered that it was carbon. But soon questions were asked by the experimenting group as well as the others. The teacher suggested that they might find answers to their questions by reading their textbook. They rushed for these and read avidly.

If you look over the signs of good and poor teaching, you can find the items that may be checked for these teaching performances which have here been described.

Of course, previous to the actual teaching there must be the planning for it. Naturally, the place for a teacher to start improving her teaching efficiency is in the making of plans. How then can the teacher find help in the various aspects of planning? She will find it wiser to make a general plan for teaching an entire unit than to make only a day-to-day type. Therefore, some suggested steps in planning a science unit are given:

Suggested Procedure in Planning the Teaching of a Science Unit

1. Read entire unit in the textbook.
2. List the important basic understandings that are included.
3. Read the unit again and list the experiences and activities through which each of the basic understandings may be developed.
4. Organize these around challenging problem questions.
5. Read Teachers' Manual for textbook, courses of study, and supplementary books for additional ideas.
6. List the materials and visual aids required for the above activities.
7. Make a selected list of books which will be available for children's use.
8. List the general and specific pupil needs that will be involved in the teaching of this particular unit. In other words, why teach the unit.
9. List the things or places in the community that can be used.
10. Map out the classroom procedures that can be used to advantage in this particular unit, such as:
    (a) A definite way to stimulate and hold interest in the unit.
    (b) A definite way of handling children's questions. If children are interested, they will ask questions. For example, these might be written on the blackboard and children could then help to organize their questions. The teacher could fit these into her general plan. Another way of handling children's questions is to have children suggest ways of finding the answers to their questions.
    (c) Organization of pupils. For instance, the teacher can help the children to organize into 6 or 7 groups according to their needs and interests. Each group, with the help and guidance of the teacher, can plan its own work.
    (d) The activities that can best be carried on by individuals, by the groups and by the entire class.
    (e) Ways of getting these activities carried on other than by directing them step by step.
    (f) Several questions and ways that will make the children's reading purposeful.
    (g) A way of summarizing the important ideas in the unit. Varied types of summaries should be used, such as a planned program in which the children memorize their parts; program in which the children talk informally; an exhibit; posters; a diorama; a dramatization; a radio program, etc.
    (h) Check-ups. These, too, should be varied from unit to unit. Objective tests; tests using problems, pictures, or words, phrases and sentences; tests requiring the use of knowledge in a new situation. The quiz-bee which has been popularized over the radio is a favorite also with the children. A quiz-bee may be conducted in many different ways.

The Cleveland Course of Study in Elementary Science was developed to save the teacher's time and to help her teaching become more effective. Each unit is organized into the following sections: purpose of unit; suggested problems; basic understandings; suggested teachers' and pupils' activities; materials required; bibliography; visual aids; and additional activities. The suggested problems, activities and basic understandings are set up in a three-column plan. In this way one can easily see the children's activities through which the basic understandings may be acquired. Often a teacher wishes to follow the suggested activities the first time she teaches the unit. These are apt to make her think of other ideas which she can incorporate later on.

The following is a small portion taken from the Fourth Grade Elementary Science Course of Study: Unit—How Are The Things of The World Put in Groups? This unit on classification is planned around one major activity—that of organizing the things on the science shelf. First, the living things are put at one end and the non-living at the other end. Then, the living things are separated into animals or plants. The animals are grouped under mammals, birds, fish, reptiles, amphibians and insects. The plants are separated into two groups, plants with seeds and plants without seeds. Two problems only are given below, as they indicate the smaller activities that are involved in the large unit activity.

## THE CLEVELAND COURSE OF STUDY IN ELEMENTARY SCIENCE

### GRADE FOUR

A small portion from the

### Unit—How Are The Things of The World Grouped?

| SUGGESTED PROBLEMS | SUGGESTED CHILDREN'S AND TEACHERS' ACTIVITIES | BASIC UNDERSTANDINGS |
|---|---|---|
| V. How are all reptiles alike? | Give the children an opportunity to examine specimens and pictures of reptiles. Have a turtle and a live snake in the room, if possible. Study a piece of snake skin to find the scales. Notice the scale-like plates on a turtle shell. Watch how reptiles move around.<br><br>Tell the children that animals are either cold-blooded or warm-blooded. Have them find what cold-blooded means by reading Page 29, last paragraph, in the textbook.<br><br>Emphasize meaning of cold-blooded by showing these slides:<br>Pe.4–5—Snake<br>Pe.4–3—Turtle<br>Pe.4–4—Turtle<br><br>After the children have listed in their own words the ways reptiles are alike, the list may be checked by reading pages 27–30 in the textbook.<br><br>Put all the reptiles together on the science shelf and make a label for this group. | 9. Reptiles:<br>a. Are covered with scales or plates.<br>b. Have short legs or no legs.<br>c. Are cold-blooded. |
| VII. What is an insect? | Have children bring in many live and dead insects, such as grasshoppers, crickets, butterflies, ants, wasps, etc. Help children mount dead ones on pins stuck in corks and place live insects in jars or cages.<br><br>Suggest that each group examine one kind of insect to find the following about its structure: number of legs, number of wings, number of feelers, number of parts to body, kind of covering. After each group gives its report, list on the blackboard the characteristics of that particular insect. Notice the similarity in these, and then make one list that will include characteristics common to all.<br><br>Have the group, which is examining grasshoppers, find tiny dots on side of insect's body. The class can find the use of these holes by reading Page 35, first paragraph, in the textbook. Then examine the live grasshopper to see this breathing process.<br><br>After all the insects are placed in a group on the science shelf, make a label to put beside them. | 11. An insect is an animal that:<br>a. Has six legs.<br>b. Has two feelers.<br>c. Has a body divided into three parts.<br>d. Usually has two or four wings but sometimes has none.<br>e. Has thick, hard covering on the outside.<br>f. Breathes through holes along side of its body. |

# AN ATTEMPT AT SPECIFICITY IN AN IN-SERVICE PROGRAM OF EDUCATION FOR TEACHERS OF SCIENCE

G. W. HAUPT

*State Teachers College, Glassboro, New Jersey*

There is critical need for study of the problems of in-service teachers relative to the kinds of education which will function most specifically.

Many considerations have influenced the selection of professional aids offered to teachers but sound and constant progress will be made when there is detailed analysis of difficulties with experimentation directed to determination of particularly effective solutions.

The Science Department of the New Jersey State Teachers College at Glassboro is exploring such specificity.

The kinds of service now functioning, and problems of teachers which occasioned them, will be discussed. Certain recommendations pertaining to pre-service education will also be made. This is done because of the nationally extensive and essential need of a closer correlation between pre-service and in-service education of teachers.

## KINDS OF SERVICE OPERATING FOR TEACHERS IN THE FIELD

Five distinct types of service are used at present to meet the wants of teachers. They are: (1) the demonstration lesson, (2) supervision of teaching, (3) consultation, (4) teachers' organizations and meetings and (5) extension courses.

The demonstration lesson is usually conducted within the teacher's own school although children are brought at times to the college for this purpose. The teaching is done by the college instructor of science and is followed by conference with the regular teacher of the children. Demonstration teaching is done only upon request from the regular classroom teacher.

Supervision of teaching is a regular part of the program for all junior and senior students in the college and this service is frequently provided for teachers when they make the request.

The consultative service is given within the college for those teachers who cannot or do not use the demonstration lesson or supervision of their teaching for solution of certain of their problems. There is also considerable consultation by mail.

Organization of teachers into state, county and local units for annual or semi-annual meetings is proving to be professionally effective for purposes to be described.

The extension classes are dealing with the content of the sciences and with methods of teaching this content to children. Courses are organized *comprehensively*, as "The Teaching of Science" and *intensively* as "Physics," "Astronomy," "Geology," "Biology," and so forth.

## PROBLEMS OF TEACHERS WHICH OCCASIONED THESE SERVICES

The needs of teachers in the field have determined the five kinds of service just mentioned. These needs are carefully studied relative to the kind of service which contributes most satisfactorily. All problems cannot be solved by the same method nor any problem by every method. Indeed there is notable specificity in the type of service required to meet a type of need.

The *demonstration lesson* is found to be particularly effective for solution of teacher's problems relative to (1) equipment and (2) certain features of psychology of child learning.

Typical questions from teachers pertaining to equipment which are being answered by the demonstration lesson include: How can we teach children without books? How should books be used? How can we teach without apparatus? How can we teach children who have little scientific

background? How can we interpret the environment?

Some problems pertaining to psychology of child learning which occasion the demonstration lesson are: How develop pupil interest? How teach children to study? How utilize pupil activity? How create learning situations? How place content by grades? How utilize objectives?

*Supervision* of teaching is proving valuable when applied to the solution of such problems as: How utilize lesson plans? How display the objective results of teaching? How achieve cooperation between the college and critic teacher?

The *consultative* service works well with these problems: How organize a course of study? What books shall be used? How interpret the New Jersey course of study? How prepare units of work? What is the significance of objectives? How achieve correlation of subjects? How utilize incidental instruction?

*Teachers organizations and meetings* are contributing to needs expressed in such questions as: How conduct a science assembly? How conduct a science club? How conduct a field trip? How utilize visual aids? How arrange a museum?

Questions from teachers which necessitate help from the *extension classes* by suitable interpretation of science content are: How utilize experiments effectively? What are some effective experiments for use with children? What are the principles underlying experiments? How properly emphasize all sciences? How build and use progressive and unified courses? How utilize seasonal activities?

## RECOMMENDATIONS FOR IMPROVEMENT OF PRE-SERVICE EDUCATION OF TEACHERS OF SCIENCE

Some of the problems and needs of teachers in service which have just been discussed are probably inevitable but some of them would certainly not be so acute were proper emphasis and revision provided in pre-service education.

The following recommendations for pre-service education in science can be made from indications furnished from this examination of in-service needs:

1. Courses of the "survey" type should be required. As this kind of course is usually organized there is anticipation of such in-service problems as relate to correlation, proper emphasis of all sciences, principles underlying experiments and effective utilization of objectives.
2. Courses should provide experiences with common and practical equipment. So many teachers in the field should not be at such loss to know how to teach "without apparatus," how to utilize seasonal activities, how to teach without books and the many effective experiments for use with pupils.
3. There should be attention in pre-service courses in science to the characteristics and needs of children as they relate to this area of learning. Provision could be made in the science courses in the teachers colleges for consideration of characteristic pupil interest, gradation of content, creation of learning situations and utilization of purposeful pupil activities.
4. There should be more specialization by teachers college students in functional areas of science and less in the academic divisions of science. Our teachers demand to know how to help learners interpret the environment, how to help them meet the daily needs of life, how to arrange museums and how to achieve correlation. Pre-service courses in science can be organized and taught so as to aid in solution of such problems without loss in academic rigor.
5. There should be increased emphasis upon scientific method and attitude in the college courses. If beginning teachers possessed a true comprehension of the method of science they would know how to help pupils to study science, methods of propaganda detection and analysis, ways, to create learning situations and the proper place and use of lesson plans.
6. Understanding of scientific principles should be of primary importance in the pre-service college courses in science. Teachers of science sometimes enter their profession with too many facts inadequately organized. They then seek to know how to help pupils interpret their environment, how to organize courses of study, how to construct cumulative units and ways to achieve correlation.

In all of our pre-service education in science, we need development of *functional* meanings. This applies to (1) the content courses, (2) the professional or method courses and (3) the work in practice teaching.

We then need unification of the content developed in these three areas.

# THE USE OF VISUAL MATERIALS IN ELEMENTARY SCIENCE

MARY E. STEEL

*Principal, Hobbs-Strickland Elementary School, Alice, Texas*

There is a wide-spread recognition of the fact that an acquaintance with a certain amount of applied and theoretical science is necessary for every well-adjusted individual. There is a growing realization that the scientific attitude should be acquired in the early years of school life. Elementary Science has assumed an important place in the revised curriculum.

Many techniques have been introduced into the school program to improve the quality of instruction. A great number of them belong to the field that we term *visual education. Visualizing the Curriculum,* by Hoban, Hoban, and Zisman, defines a visual aid as:

> . . . any picture, model, object, or device which provides concrete visual experience to the learner for the purpose of (1) introducing, building up, enriching, or clarifying abstract concepts, (2) developing desirable attitudes, and (3) stimulating further activity on the part of the learner.

Our schools are filled with the vehicles of visual education: blackboards, bulletin boards, charts, posters, pictures, projectors, and many others. The present need is not for more types of visual aids, but for a systematic treatment of the relation between materials and the learning process.

The following general suggestions may be applied as criteria for visual materials: (1) Materials should make a direct contribution to the unit of study. (2) Materials should be suited to the age and understanding of the group. (3) Materials should provide for individual differences and for individual growth within group activity. (4) Materials should be valid in the light of known truths and facts. (5) Materials having permanent value should be given preference over those with temporary or passing interest. (6) A variety of materials should be used.

In learning, a child proceeds from the concrete to the abstract. Certain instructional aids are suitable to the various stages of his development. The total situation is the most effective teaching aid in the lower grades. The aids to learning range, in order of increasing difficulty, from the total situation, through objects, models, films, stereographs, slides, pictures, and diagrams, to the printed word which is conceded to be the most difficult of all the visual aids.

Visual aids are classified in this discussion as follows: (1) *the school journey,* (2) *museum materials,* (3) *pictorial materials,* and (4) *miscellaneous aids.*

*The School Journey.* The school journey, often called a field trip or excursion, is the most effective visual aid available. The school journey is not in itself a visual aid, but it is the vehicle through which experience becomes a visual aid. It makes the real situation the learning situation. School journeys provide a means of enriching the experiences of children, give teachers the opportunity to present subjects in their natural setting, offer concrete evidence necessary to clarify instruction, help correlate school work with actual life, and aid in developing the habit of keen observation.

School journeys should involve careful planning by the teacher, a period of preparation by the class during which reference materials and available data are assembled, the actual journey with its definite lesson, and the follow-up, including reports, discussions, questions, and the evaluation of the material gained.

A few examples of school journeys in elementary science are:

(1) A trip to the local ice plant to observe the making of ice.

(2) A visit to the telegraph office to watch the sending and receiving of messages.

(3) A visit to the U. S. Weather Bureau station to see the instruments used in making weather forecasts and to examine weather charts.

(4) A trip to a nearby wood or park to observe and identify birds, insects, or plants.

(5) A visit to the furnace room of the school or some other public building to see the central heating system.

(6) A visit to a new home to observe new types of construction and lighting.

(7) A visit to an airport, a railway station, a bus terminal, and a passenger ship to observe and compare types of travel.

(8) A trip to an aquarium to study water life.

(9) A visit to a modern dairy to see operations involved in supplying the milk demands of the city.

(10) A trip to a museum.

*Museum Materials.* Museum materials include many types of objects, such as Indian arrows, shells, and rocks; many types of specimens, such as animals, leaves, and plants; and many types of models, such as miniature houses, trains, automobiles, airplanes, and boats.

Materials may be collected from the home, from the school area, from commercial and industrial establishments, from other schools (exchange exhibits), and from museums which prepare exhibits for school use.

The organization and classification of musem materials determine to some extent whether or not the museum will be of value to the school program. Care should be taken to make of the museum something more than a display. Only such materials should be assembled as relate to the school program. Materials should be labeled and arranged so as to be accessible to teachers and pupils. Labels should be brief, simple, clear. Bottles and boxes should be of uniform size when possible.

In classification, curriculum units should be kept in mind.

*Pictorial Materials.* Textbook illustrations, post cards, flat pictures, stereographs, lantern slides, and motion pictures are some of the aids that belong in this very inclusive group. To use pictorial materials effectively teachers must have standards of evaluation, definite techniques for instructional procedure, and the ability to adapt them to the curriculum.

Pictures are the most easily obtained of all visual materials. Some likely sources are newspapers, travel booklets, and magazines. *National Geographic Magazine, Junior Natural History, Nature Magazine,* and *Life* are a few of the magazines that offer good picture material to the science teacher.

Pictures are not mere illustrative aids but valuable sources of information and should be selected with great care. To improve instruction with pictures the following suggestions are offered:

(1) All pictures should be clear and distinct.
(2) A simple picture showing one object rather than many is best for teaching purposes.
(3) Pictures should show actual conditions.
(4) Colored pictures are preferred.
(5) Pictures should be uniformly mounted. On the reverse side there should be a suggested study guide, a check-up test, a selected vocabulary, or an informational paragraph.
(6) The picture collection should be so organized in the files by subjects, units, and topics that any picture may be located quickly.

The stereograph is a double photograph, two pictures made by a stereoscopic camera, each from a slightly different angle, which are enlarged and merged into a single image by the lenses of the stereoscope. A stereographic view seen through the stereoscope gives the looker an illusion of approximately the same depth and relationship in space which he gets in natural life from the use of two normal eyes.

Stereographs are not intended for group

teaching. They are individualistic and should be used as such. The stereograph and the lantern slide go hand in hand, the stereograph for individual teaching and the lantern slide for group instruction. The stereograph should be used during the preparation of the lesson by individual pupils and the slide should be used during the class period for a group activity.

In the primary grades only a few stereographs should be placed on the table at one time. They should have a definite relation to the unit.

Stereographs should be arranged in small, carefully selected units. Explanations should be on the back.

Many excellent stereographs on elementary science subjects are available.

A lantern slide projected on a screen is a two-dimension picture intended for observation and study. Slides may be used to introduce, clarify, or supplement subject matter. Slides may be bought, rented, borrowed, or made by teachers and pupils. To be of great value, slides should be of high quality, clear in detail, and definitely related to the curriculum requirements. They should be true to fact and free from distortion or illusion. The view should include an element known to the pupils so that they may judge dimensions of unknown elements. The use of lantern slides is a very effective and comparatively inexpensive method of presenting many phases of elementary science.

Opaque projection allows the showing for group use of non-transparent material like textbook selections, book illustrations, photographic prints, and flat specimens such as leaves and coins. These materials are reflected on a screen by means of an opaque projector. An opaque projection attachment may be used with a lantern if desired. Much good material is made available for class use at little cost.

The motion picture makes a definite contribution to science. It is able to overcome limitations of time, space, and human vision. It pictures action which takes place too quickly, too slowly, too minutely, on too broad a scale, or in such physical relations as to be invisible to the unaided eye.

The motion picture may be used (1) to stimulate interest in a new topic, (2) as a direct teaching aid in presenting information, (3) to enrich or extend the content of a unit, and (4) to summarize or review a unit of work.

Motion pictures should be used only when they contribute to the unit being studied. The teacher should make a definite preparation before presenting it to the pupils.

Educational motion pictures may be bought, rented, or borrowed. Many state universities and education departments maintain visual education bureaus from which films and slides may be borrowed or rented for a nominal fee. In many cases the only cost is the payment of transportation charges.

*Miscellaneous Aids.* Posters, charts, graphs, demonstrations, and hobbies are a few miscellaneous aids that make valuable contributions to elementary science.

The poster contains one dominant idea and is developed by means that will portray it effectively. Photography, cut-out forms, and pictures to be pasted together form the bases for most posters. Lettering should be clear and readable from all points in the room. Posters may be made by pupils and teachers. Others may be procured from commercial companies, industrial concerns, and government agencies.

A chart is a formal arrangement of facts for making comparisons, for summarizing, and for showing quantities and developments. Charts for classroom use should be visible from all points in the room, should be attractive, and should set forth one idea.

Graphs are charts presenting statistics and relations of quantities to time. The most used are pictorial statistics, bar graphs, area diagrams, and line graphs.

There are many science activities which may be presented effectively by means of demonstrations. A few suggested demonstrations are: a demonstration of a balanced meal; a demonstration of musical instruments, showing how each is played and how all of them sound when played by a number of people at once; and a first-aid demonstration.

Teachers have to recognize the fact that hobbies help to motivate school work, to gain the attention of the uninterested child, and to develop interests, tastes, and skills that later insure the wise use of leisure.

Ethel R. Taylor has given us a delightful little jingle based on Mother Goose:

> Ride a hob horse that gallops and spills
> Into your lap new adventures and thrills.
> Rocks, kites, or ribbons, or dolls in a row,
> You'll have excitement wherever you go.

The value of collections as hobbies is obvious. A few of those that make definite science contributions are: plant collections; leaf, seed, and twig collections; rock and shell collections; and local products collections.

Many science activities may lead to lasting interests. Amateur photography and the making of blue-print Christmas cards are examples of creative hobbies resulting from elementary science units.

The use of visual materials in elementary science classes creates interest, inspires individual and group effort, supplements textbook and reference materials, and clarifies instruction. However, much depends on the teacher and the presentation of materials. If the science teacher has an inquiring mind, a keen interest in the contribution of science to life, and the ability to adapt materials to the level of elementary children, the pupils will develop a scientific attitude. When this has been accomplished, elementary science will have advanced to a higher rung in the ladder of importance in the school curriculum.

## ELEMENTARY SCIENCE CONTENT

PHILIP B. SHARPE

*Greenwich High School, Greenwich, New York*

Why do we believe that the content of science for grades one to at least nine should be immediately useful to the pupils? Because:

1. Much of the value of science lies in the useful information it produces, therefore the pupil should find his science useful.

2. Youngsters normally wish to know innumerable useful things such as—what rabbits eat, how to blow soap bubbles, how to solder pots and pans, etc. etc.—things in the province of science with no artificial motivation needed.

3. Interest is liable to be so intense, and the things learned so promptly and frequently applied in the home (if really useful) that the learning is thorough.

4. Functional science also offers an unusual and unequalled opportunity for practice in scientific method. This, we are coming to believe, outweighs all other considerations.

5. We may hope that with science made immediately useful and therefore vital, formal schooling will not so quickly deaden the eager curiosity of childhood into the blasé indifference of the Sophomore.

Of course we are aiming high and an entirely satisfactory body of science subject matter for each grade cannot be compiled at once or ever. Certainly it cannot be even approached by any author who bases his list on general considerations alone. And it would seem evident that the satis-

factory body of subject matter would be a constantly changing one. Child interests change very rapidly sometimes, as do our own, perhaps as a result of an article in a magazine or Sunday paper, an advertisement of a new toy or door chime, a circus stunt, almost anything. It is desirable to catch and point every such interest. The content must be flexible, not rigid. The many studies of child interest show at least this; the need of opportunistic teaching.

Here is a suggestion. The best basis for a worthwhile syllabus (to be followed only when fresher interests are lacking) might be a classified list of the questions of the children themselves, compiled over a period of years and constantly being revised. To secure some continuity and to avoid too much repetition throughout the grades, it might be desirable for each teacher to add a copy of her science study plans and records for the year to those she received with the incoming class, and pass them all along with that class to their next teacher. Thus each teacher could know clearly just what her group has done in science in earlier grades.

Now this may seem at first glance to be a shockingly casual sort of way in which to cover the ground, but:

1. We are not primarily interested in covering ground, but in really teaching a little science.

2. We can probably depend on the normal unspoiled groups, as they reach the proper ages, to becomes interested more or less spontaneously in almost everything that concerns them.

3. By helping the pupil in *his* activity instead of stuffing facts down his throat when he is not hungry for those particular facts, we avoid a violent reaction and subsequent lethargy.

4. By helping him to solve *his* problems we befriend him and help him to become enthusiastically scientific, whereas the ground-covering aim is apt to lead us into estranging him and making him antagonistic.

And in the long run it may be expected that the pupils will learn approximately the same things by this method as by a rigidly constructed syllabus. We believe that they will learn more things, learn them more thoroughly, and learn them more joyously (no crime in that!). Its effectiveness in giving scientific methods and scientific traits promises to be unique. And after all, it is the simple way—to utilize the child's natural thirst for knowledge instead of striving to create an artificial one or an artificially timed one. Why not adapt our procedure to the child and his nature in such unessential matters as rigid lesson plans, so that we can adapt the growing child to our larger and more important syllabus — that of training intelligent, healthy, self-reliant, stable, and scientific Americans?

# SCIENCE IS FUN WHEN YOU KNOW HOW AND WHY

ELLEN HARTNETT

*County Superintendent of Schools, Jasper County, Iowa*

There are many reasons why teachers have avoided adding another course to an already crowded curriculum. Elementary science programs which have been set up by an over-ambitious supervisor, are often stumbling blocks not easy to overcome.

Since elementary teachers need guidance and training in the science program which they are to teach, it is advisable to choose a book or guide which gives specific helps for teachers as well as for pupils.

In preparing a program, it is important to choose material that is not too difficult for the grade that is to use it, and the teacher's manual that is adopted should give suggestions and references that are easily found. Explanations of new material which is to be introduced by the teacher should be presented interestingly and vividly to the teachers.

Many of the elementary teachers called upon to teach science have had no particular training in this field, but usually they are willing to try and are anxious to present the material in an interesting manner. The teacher who feels herself lacking in special preparation in this or any other subject need have no fear if she has a sound philosophy of education and an understanding supervisor for a helper.

The teacher should first be introduced to the subject of science before she should be expected to introduce the subject to her class. This presentation of the teacher to the materials can be done in group meetings. This usually makes for a better understanding of the subject matter, and also gives the teacher a feeling of self confidence. Any alert, observing person is usually capable of teaching science in the elementary grades. It is not necessary for a teacher to have had extensive science courses to be a good elementary science teacher. It is necessary, however, for the teacher to show an interest in the subject and give it considerable study.

Parents should also be "let in on" the plans when an elementary science program is being introduced for the first time, or misunderstandings may arise. A few parents who have not understood the program have accused the teacher of introducing materials too difficult for the pupils. One mother was quoted as saying she didn't study such subjects until she was in college.

Every child-centered school is interested in developing the possibilities within each child. It is our duty as educators to teach each child to meet new problems gracefully. Elementary science is an especially good field for doing this, for it develops initiative in the pupils. Science activity-projects teach the child to meet and also to solve a great number of important problems.

There is a noticeable trend to make youth aware of the many existing social problems, and this instruction can be interwoven with significant scientific information. For example, the problem of forestry is both a social and a scientific one, as is also the study of weeds or the study of insects.

The activities developed through an original science program will create interest in other subjects also. To be able to perform science experiments, children must know how to read, how to follow instructions, and how to compute simple problems. A general understanding of other subjects makes science definitely more real. I have known children to put forth a greater effort to understand other material subjects, in order that more time might be spent in the science laboratory group.

Science programs have an unusual value in taking care of individual differences. The slow pupils of other subjects are often the stars of the science class. One teacher reports that a fourth grade boy who had an unusual amount of first-hand knowledge about snakes found it necessary to be able to read in order to learn about specimens in which he was interested.

A crowded curriculum is often used as an excuse for the absence of science from the program. However, progressive teachers have been able to include science by the integration of it with the traditional subjects.

Sometimes an overcrowded schoolroom leads to problems when space is needed to perform laboratory experiments. This difficulty may be minimized by having many of the activities conducted out of doors.

Occasionally a teacher insists she does not have the proper materials with which to teach science, but an enterprising supervisor can easily show her how most of the experiments can be performed with inexpensive or free materials. Many useful science materials may be found in rubbish piles or at a city junk heap. I think teachers overestimate the difficulty of getting science apparatus. The pupils are usually willing and anxious to bring in many materials which can be useful in the science class. One of my science classes, in searching for copper wire at the city dump, unearthed some choice cocoons which the children were proud to carry back to the school. The real problem is not one of finding materials; it is one of getting this fascinating program started.

Elementary science must be a part of the regular school program. Unless a definite place is made for science on the program, the subject is often neglected. The routine subjects often crowd out the more attractive, but equally necessary, subjects from the schedule.

Probably two of the most important aims in teaching elementary science are interest and satisfaction. They may be cultivated and developed through observation of many phenomena varying from birds and insects to weather changes. The habit of observation should be developed, not only for scientific knowledge, but also for the development of a well-rounded individual.

Children are more interested in following an observation question if the teacher knows more about the subject than the pupils, thus being capable of leading the group. The teacher also must learn to give credit where credit is due, and when an interesting observation has been made, Johnny or Mary should be encouraged to tell the rest of the group about the discovery. Of course, the child must learn to express himself clearly and interestingly, and this gives an opportunity for an integration of elementary science and other subjects—especially English.

Many times a "Have you noticed?" or "What do you think causes?" is all that is needed to discover that the child is very much interested in the changing world about him. A field trip that has been well planned can be very valuable in elementary science, for it is possible to find a pond, a stream, a field, a meadow, or even a town park that is full of science materials. A good teacher who is teaching elementary science for the first time wisely plans a field trip by going beforehand and marking the trail. Then she is able to tell the pupils what she expects them to find on the trip. However, even with the best of planning, questions will be asked about specimens which the teacher does not recognize. If she is honest when the children ask questions that she cannot answer, and says, "Let's find this out together," the pupils will respect her more highly and will also develop an investigative attitude. It does not make for a wholesome situation for the teacher to know all of the answers. Many times a gleam of satisfaction comes to a child when he discovers that he has found something that the teacher does not know.

Growing house plants, garden flowers, and wild flowers from seeds, and the planting of trees on Arbor Day or on birthdays make interesting school projects which are of interest to both the parents and the children. One of my teachers last year had each child plant a tree on the school ground and dedicate it to some member of the family. Much interest was developed in the project, and some of the parents assisted by ordering trees from a nursery, while others went with the children to a river for their plantings.

The rearing of animals in the schoolroom makes an interesting and worthy project for some groups. Although many adults fear such animals as snakes, toads, or frogs, children seldom have any fear, and they will not only bring them to school, but they will also care for them and record observations of their habits. One outstanding elementary science teacher admitted to me privately that she loathed snakes, but her class never realized it because of the way she conducted investigations. She encouraged the children to handle the animals and taught them correct ways to handle them.

Collecting science specimens is interesting to all ages of children. Some are fascinated by rocks and minerals, others by leaves, seeds, or perhaps kinds of wood. Sometimes it is not only the students in the class, but the whole family that makes interesting science contributions. In one mining camp, an interest that began in the schoolroom resulted in many of the miners bringing fossil specimens out of the mine for the children to carry to school. The children and parents were working on a common problem, but the problem was considered play, not work, because of a particular satisfaction which took place in the cooperative efforts.

When growing boys and girls go through the "pounding and hammering" stage of development, they can make many useful articles as a result of their science study—bird houses, feeding stations, fountains, insect cages, animal pens, weather vanes, etc.

Christmas toys brought to school following the holidays often introduce interesting science experiments which fascinate pupils and lead them to formulate valuable generalizations.

One of the simplest of all science activities is that of keeping a weather record. Some teachers encourage their group to keep nature calendars, to encourage the students to keep diaries and scrapbooks about the weather. They may also include other science activities of special interest. Along with this project, some children keep a file of references which they have read in newspapers, magazines, textbooks, or library books. The articles are not copied; they are merely catalogued by subject.

Someone has said curiosity is one of the most essential of all scientific attitudes, and we must agree that children are overendowed with this faculty. If we are to be good teachers of elementary science, we must be especially tolerant of this trait and encourage each child to be curious, let him know he has a right to check things he does not believe, and let him search out truths. Too many times in the old school the child was taught to be seen and not heard, and he consequently felt very limited in the contribution which he could make, no matter how capable he was of making a contribution. The young child is so willing to help, and so unbiased in his opinions, that many desired social outcomes will develop if he is given an opportunity.

A well-planned science program is not confined by a supervisor or a textbook, but it develops along with the interests of the group. If every problem could arise from the entire group, a more organized effort would be put forth to study every problem thoroughly. But many times projects interest only one member of the class. There is value in allowing a pupil to pursue a problem of particular interest to himself.

While group studies teach many lessons in cooperation, there is also much to be said for individual projects.

It makes little difference whether an elementary science problem is introduced by the teacher or by one of the pupils. However, if the pupils are not interested or eager to go ahead with an activity, it is best to drop the subject and to find a similar topic that interests the group. It is very important that the teacher does not do too much of the planning. Although the teacher's way of developing the project may be time-saving, she must not forget that pupils get much value from developing the project themselves (under the teacher's guidance).

The name "science" comes from the Latin "scio," meaning *I know*, and the scientist is one who knows what he knows through experiment and research. No matter whether this scientist is a primary pupil in the classroom, a college student in the laboratory, or perhaps a teacher in a rural school, he finds true the saying: Science is fun when you know how and why.

## THE PROBLEMS OF AN ELEMENTARY SCIENCE TEACHER

HELEN V. COPPERSMITH
*Youngstown, Ohio*

Science is not a new subject in the elementary school, but it still presents many problems to the elementary teacher. Some of these problems cause a great deal of anxiety. They are the problems, which, if not solved, make the teaching of science merely another twenty minutes in an already overcrowded program, another vocabulary drill and reading lesson, or a cut and well-dried question and answer game. Science in the grades can be as exciting as a trip with Frank Buck or a visit to a zoo, as interesting as pet dogs and mice, as beautiful as storms and sunsets.

One problem usually facing a teacher of elementary science is his lack of training in this field. Teacher training institutions are beginning to offer courses to help correct this deficiency. These courses should be very flexible to take into consideration the teacher's previous training and experiences. Such courses must be planned to meet individual needs of the prospective teacher, and not as required and standardized courses with so many college credits. This, in time, will provide an elementary teacher who will have a broad, general scientific background. However, a teacher now in service may avail himself of university extension courses, summer session courses, visits to an outstanding elementary teacher of science or to a school science center. The elementary teacher must by any, or all, of these means prepare himself to guide the child in his study of science. With extra effort, the teacher-guide can share with the child the experiences, the thrill of exploration, discovery, and satisfaction instead of "putting in" a science period which stifles the interest and initiative.

The elementary teacher of science must clearly define what shall be accomplished—in which direction the activities of the child shall be guided—when determining what method, or general plan of teaching science shall be used. This indeed requires work—planning and organization—to keep it elastic to the pupil rather than elevator-like—up and down—going nowhere. In selecting any general flexible plan of procedure, the teacher should be certain that the method followed will insure the child's understanding of the meaning of scientific words, terms and symbols. A recent check

has shown that a course in general science for one semester contains as many new words to be learned as does a semester course in a foreign language. A child may be able to reflect in mirror-fashion definitions found in dictionaries, but it is of vast importance that he has a thorough understanding of the words and terms used. This understanding must be gradually developed. It must be built upon and enlarged year by year until it is finally a broad concept. A first grade child may close his eyes, place both hands over them, and say, "I can see nothing." When he removes his hands, open his eyes, he discovers he can see. He, through such a simple experience, discovers he needs light in order to see. Thus he begins very simply to build the concept of light.

Will the general procedure teach the child basic truths? It is of prime importance for a child to understand, that, as far as man is able to discover, certain things are fundamental. In a constantly changing, unsettled world, a child needs a firm, sound foundation upon which to base his thinking and actions. The teacher must be sure, however, that the method does not present these truths as dogma. The child's mind must be kept open to the idea of change, or possibility of change, in even these fundamental truths. He must learn to collect data, weigh it, then draw as accurate a conclusion as possible. No one knows what the child will be required to face as an adult or what his environment will be. All that can be done is to guide him in the scientific procedure of solving any problems with which he may be faced.

Will the method selected enable the child to have innumerable interactions with his environment? It is through these experiences that he learns. Many, varied experiences should be provided, some simple and some complex, all showing the same results. If the child is studying seeds and the force they exert in growing, many experiments with seeds should be used. He may have jars half-full of many kinds of seeds, place a weight upon the top of the seeds in each jar, cover the seeds with water, and observe the results. He then could put seeds in a potato ricer, place it with the seeds in water and again observe the results. The young explorer then discovers seeds, in general, exert enough force when growing to lift many times their own weight. The experiences should be kept simple and practical, using everyday things with which the child is familiar. They should be ones the child can understand and achieve.

The method used should include all the children. This does not mean "mass" education, but it means grouping the children in small working groups to carry on their experiments. By careful grouping each child can take an active part—not one of wishful looking, or blank staring—in bringing the experiment to a satisfactory conclusion. Working thus in small homogeneous groups, the young scientist develops initiative; learns group cooperation, a sense of responsibility and the sharing of ideas so necessary to our "way of life."

What provision is made, by the selected method, for the written and oral expression of ideas and observations? Can the child describe and explain clearly and concisely his experiences? Does the child, when asked, "What are you studying in science?" reply, "I don't know, the teacher put water in a glass—placed it on the window ledge an' said we were to watch it." To the query, "What happened?" is the reply a bored, "I don't know. Nothin' I guess." Or does the child exclaim, "Know what I'm doing? I'm finding out what happens to a raindrop. I put water into two jars, marked the water level with rubber bands, put a lid on one jar, left the other uncovered and set both on the window ledge. What do *you* think happened? The water from one jar evaporated—that means it changed from the liquid water in the jar to water vapor in the air. You

can't see water vapor. The water in the open jar evaporated quickly but in the covered jar there was little difference in the water level after I had watched it for nearly a week." Interest here? Definitely! The child has substituted the active doing, observing, thinking and expressing, for the reading, picture-book explanation.

Whichever method or procedure is used, it must be judged, finally, in the light of the effect and changes it will cause in the life of the child. The teacher must keep in mind that this child with insatiable curiosity is not a storehouse to be stocked with information filed under conventional headings; he is a one-man expeditionary force, exploring, probing, examining, questioning his environment. Any method used is one which provides Tom, the average, John, the plodder, and Jim, the studious, avenues for the exercise and development of his respective power of initiative and expression.

When a teacher has traveled this far in thinking about the problem of science teaching in the elementary school, the wail ascends, "How can I direct forty children of different and distinct levels of understanding and growth in finding adequate avenues of expression in science? Getting a child to do regular and uniform assignments is headache enough! I just don't have time to do this science work in addition to the 'essential' studies." If the child is interested, he will find time outside of school to carry out many of his experiments and observations. This is the desirable thing. The teacher must never lose the broad vision of educating the child for life now as he goes along—not for the future. Who can foretell exactly what his future will be? Here then, is one of the outstanding aims of teaching science in the elementary school—worthwhile things to do in leisure time, cooperation through working with friends and parents upon some experiment. The parents become interested in what keeps Willie engrossed in working instead of racing noisily through the house and neighborhood demanding, "What's there to do? Can I have a dime for the movies?" The parents, their interest aroused, watch, question, and finally join Willie at his exciting "puttering." This carries the elementary school program directly to the community, and builds a closer bond between home, industry and the school.

Lastly to be considered, is the problem of measuring the progress of the child and the changes that have been produced. What shall the "standard of measurement" be? Again the problem must be considered in the light of the individual child. With one child the arousing of his interest, as indicated by the asking of questions, shows the beginning of his progress; with another, if he is a poor reader, the selection of books, the outside reading he does; with another, the amount of leisure time he spends pursuing an interest he, with the help of the teacher, has developed, or the research he does upon a subject interesting to him. Any measurement used needs to be spread over a long period of time. A child matures and progresses slowly, not like Jack's beanstalk. Measurements should attempt to diagnose and ascertain the child's growth in self-direction, social attitudes, scientific problem-solving and in the understanding of broad concepts. The goal is the growth, activity and development of the child.

Teaching science in the elementary school is a tremendous task requiring the constant changing of procedure, analysis of each new situation, gathering new data. The teacher who is not willing to do this, who merely passes on the information he has been taught, who thinks the effort is too great, should change his work. True, the teaching of elementary science should sweep the teacher along like a surging river. This is so much more exciting and adventuresome than a stagnant pool. Mosquitoes can be pesky!

# BEGINNING THE YOUNG SCIENTISTS CLUB *

ELEANOR L. O. HEISLER
*Midland School No. 1, Rochelle Park, New Jersey*

The work to be accomplished in our 5B Civics was becoming familiar with the Constitution of the United States. When a new subject is to be studied or a new goal is set for the class, the children decide by what method they shall make their approach. The children listened to how and why our Constitution was made and decided to form a club of their own, paralleling our Constitution.

The children were given time to think about the kind of club they desired. Good reasons were to be given with the choice of the club. Unanimously the class decided upon a Science Club. The children looked up science material in books, magazines, periodicals of all kinds, pamphlets, asked parents and friends who knew something of science and its achievements and from lively discussions in class evolved the objects of their club.

The children submitted several names for the club and after many discussions decided to name it the "Young Scientists Club." For the objects of the club we'll look in the secretary's book.

*March 12 Meeting*

The meeting came to order at quarter after two. The Treasurer and the Secretary gave their reports. We were talking about the Constitution. We are now on Article II

*Article II.* The objects of our club are to interest everyone in Science because it helps everyone to live better.

1. In living things
   (a) Plants in our gardens—food—beauty.
   (b) Insects—which help or are enemies.
   (c) Trees—give fruit—shade—beauty—sap used in maple sugar—rubber—keep soil in place—paper.
   (d) All of our food comes directly or indirectly from the green leaves. They get their energy from the sun, rain and soil.
   (e) Animals—food—useful—pets.
   (f) People—work—live—play in healthy happy conditions.

The meeting was adjourned at 23 to 3.

*Secretary*—Grace C.

*March 13 Meeting*

The meeting came to order at quarter after nine. The Treasurer and the Secretary gave their reports. We continued talking about Article II

   (g) Birds—eat harmful insects—beauty—music.
   (h) Fish—frog—crabs—eels—snakes—alligators and many others of this group.

2. In things not living
   (a) Airplanes—automobiles—locomotives—steamers—motors and engines.
   (b) Telephone—wireless—cablegraph—telegraph—radio—television.
   (c) Rock and minerals—coal—petroleum—iron—steel.
   (d) Stars and solar system—telescope.
   (e) Water—uses—power—destruction, floods.
   (f) Manufacturing—clothing—glass—utensils—tools—ceramics.
   (g) Electricity—batteries.
   (h) Construction—bridges—buildings—highways.
   (i) Photography—development of pictures—camera.
   (j) Scientists—Galileo—Leuwenhoek—Pasteur.
   (k) Chemistry—serum—medicines—fire extinguishers—fire crackers—dynamite.
   (l) Superstitions—not founded on scientific facts.
3. Instruments used are—microscope and telescope.

The class discussed making exhibits to show the objects of the club. The meeting was adjourned at 10:40.

*Secretary*—Grace C.

These meetings included reading lessons, English lessons, art lessons, science lessons and civics lessons well integrated.

The President and Vice President alternated at leading the meetings. They came to the sponsor before the meeting and discussed the main issue of the meeting and

* *Editor's Note: This article was submitted directly to the Editor, and is not a contribution of the N.C.E.S. committee.*

procedures. During the meetings the Constitution of the United States was read to find out what was needed in a constitution, what the duties of the officers are, how they are elected, why changes should occur, what provisions are made for them, why a more elaborate constitution is needed for our country than for our club, why a constitution is necessary to any organization, and many problems which could be solved or raised through the constitution.

In the beginning the children were backward, unable to express themselves properly, found it difficult to lead, talked out of turn, giggled instead of expressing an idea which had formulated while seated, often forgot when standing on their feet. These difficulties and others were slowly obliterated and at the end of the term had disappeared entirely and in their stead, individuals who could stand on their two feet in good posture, wait to be recognized, and express themselves in good English without forgetting an idea. On many issues excellent arguments were given for both sides, the evidence weighed and voted upon. Open-mindedness became a habit.

Some days special meetings were called, especially if the spirit of enthusiasm was present as in the deciding of the motto and insignia or when some matter of importance was suggested for the club. The following are minutes of a special meeting.

*April 7 Meeting*

A special meeting came to order at 10 o'clock because of Assembly Friday.

The Assistant Treasurer and the Secretary gave their reports.

Fred B. suggested that we have little books with the Constitution and the Heavens and so forth. We are going to use the typewriter for it. Billy M., Frank F., Albert McC., Lois S. and Harold G. will typewrite. Lois suggested we have our committee count tent caterpillars.* Albert, Lois, Billy and Frank will do it.

We have a Sergeant at Arms. He is Richard Killian. He is supposed to see that nobody talks and keeps the meeting in order.

We read the Constitution to find out if it will be adopted. We added a few things to it. We could not finish reading the Constitution because our time was up.

The meeting was adjourned at half past ten.

*Secretary*—Grace C.

*April 23 Meeting*

We had an informal meeting at 11 o'clock. Our teacher showed us different things about acids and alkali. She showed us that vinegar is acid and soap is alkali. The way she did it—she had a pink slip of paper and a blue slip of paper called litmus, which were sensitive to acids and akalies. If the blue turned pink, it was acid. If the pink turned blue, it was alkali. She showed us many other things, too.

The meeting was adjourned at 25 after 11.

*Secretary*—Grace C.

The minutes of April 23 include in "many other things" test tube supports, beakers, test tubes, a funnel, filter paper and a test tube holder besides litmus. A few simple experiments demonstrated some uses of the apparatus. The children thought it delightful and immediately wanted to know how much it would cost for each member to have the same equipment. This afforded the opportunity in "problem solving" in arithmetic—painlessly administered!

The following problems were used. The prices were quoted from two catalogues for science equipment in schools. The children were interested in finding out the cost of other articles and used the questions for arithmetic problems.

PROBLEM SOLVING Grade 5

Problems for equipping children in club with test tubes, test tube supports, beakers, funnels, etc. (Samples of apparatus in front of room where children could see them and come up and examine them.)

1. There are 28 children in club who need 9 test tubes each. How many test tubes will be needed?

Steps in solution of problem

1. What does the problem ask?
2. What does the problem give?
3. How shall we use these facts?
4. What is the approximate answer?

2. The test tubes are bought by the dozen. How many dozen will be needed?

Repeat steps. What of No. 1 must we use in No. 2?

3. The children buy test tubes priced one dozen for $.35. How much do the test tubes cost?

*The children had sponsored a campaign against the caterpillars.

Repeat steps. What of No. 2 must we use in No. 3?

4. Test tube supports are needed. The children spend $21.00 for them. How much was each test tube support?

Repeat steps. What of No. 1 must be used in No. 4?

5. How much more was spent for test tube supports than for test tubes?

Repeat steps. Adding which examples will give us the numbers to be used in this problem?

6. Each child would like to have 4 sizes of beakers. The prices are: No. 1—19¢, No. 2—25¢, No. 3—35¢, No. 4—54¢.

(a) How much would one set of beakers cost for one child?

(b) How much would it cost to give each child a set?

Repeat steps—answering (a) first. For (b) part what of No. 1 must we use?

7. The children decide to buy one beaker for each and spend $5.32. How much do they spend for each beaker? What number beaker was it?

Repeat steps in 2 parts. 1st part—what of No. 1 must we use? 2nd part—which example tells the number of beakers?

8. How much do the children spend on test tubes, test tube supports, and beakers?

Repeat steps. Which examples tell us how much was spent on each?

9. The children had $74.51 in the treasury before buying anything. How much money is left in the treasury after buying equipment?

Repeat steps. What of No. 8 must we use in No. 9?

10. Of the money left $10.64 is spent for funnels for class. How much is spent for each funnel?

Repeat steps. What of No. 1 must we use in No. 10?

11. How much is left in the treasury now?

Repeat steps. What of No. 9 must we know? What of No. 10?

We had a treasury hoping to buy some supplies with the money in it. The dues were one cent per week voted upon by the children. The treasurer and assistant treasurer kept a record of the dues paid. The money was handed to me after each meeting and was taken to our Principal who takes charge of the school moneys. Slips were handed to the delinquents when they owed five cents. The children kept careful record and each child might look at book with treasurer to see how much he owed and when he paid last. When paying, he was designated to stand by treasurer with money until it was properly recorded.

The Constitution Books were assembled during the meeting of April 24. The children's enthusiasm and joy knew no bounds. They decided to publish another book in the name of the club. They were very pleased that our Principal had mimeographed the books for them. The following is the letter sent to Miss Scott in appreciation of her kindness:

Midland School
Rochelle Ave.
Rochelle Park, N. J.
April 24

Dear Miss Scott,

"The Young Scientists Club" thank you very much for printing the constitution books. We are very much pleased to have you as a member, so we are sending you a constitution book as each member has one.

Yours truly,
"The Young Scientists Club"
Dorothy S.—Assistant Secretary

During the next meeting the children planned a Health Play using cleanliness as a requisite of good health. The scene depicted a slum district where flies and mosquitoes were abundant. After a child becomes ill good citizens come to the aid by cleaning up the yard, redecorating the house, exterminating the insects and their breeding places and screens are placed in the windows and doors. Children then come out and play in a healthy, happy environment.

The children were very fond of their insignia. They had discussed what could be done so that each member could wear one on his sweater, bathing suit or dress; and had decided to buy yellow material and blue thread making the design in blue. Before any material could be purchased, the size of the insignia had to be considered. After the amount of material was carefully calculated, the purchasing committee was ready to buy. The assistant secretary's mother owned a store and gave the children the material. The thread was purchased and the children went to work. The design was drawn free-hand, then traced on the material. Many children

who liked to sew brought needles and embroidery hoops and went to work during art period and spare time. Boys and girls alike—and for a time the boys appeared to be the better sewers.

A letter of appreciation was sent to Mrs. S. for her kindness.

The members of the class who did not sew during Art were drawing pictures for the Plant Book, mention of which is made in the following minutes of May 14th. The style of writing is improving as you will notice when reading these minutes:

*May 14 Meeting*

The meeting came to order at 5 to 2. The Treasurer and Secretary gave their reports. We took a vote to see if we are going to the Nature Fair as a club, we are. We discussed about who would donate cars. We are writing letters asking Miss Scott, Mrs. Holtenhof and Mrs. McCarthy. Miss Heisler said she would donate her car. We discussed about our garden book. Some members are making a cover. Other members are going to draw the pictures inside the book. We will keep the same typewriting committee.

The meeting was adjourned at quarter after 2.

*Secretary*—Grace C.

The Nature Fair was held in another community and was enjoyed by the children. Many ideas suggested themselves to the children as they walked around the exhibits which children of that school had made. The children talked to the other children commenting on the exhibits. The trip was taken after school.

The "garden book" was later called "Plant Life" and was an outgrowth of the club. Every piece of work the children did in all subjects was done as a club, whether written or oral. The children had broadened and a very definite spirit of friendliness, helpfulness, and cooperation was creeping into all subjects.

Before the end of the term the children had decided to make exhibits during the summer about the objects of the club. Each child had his own idea which he intended to carry out. The children hoped to expand the club the following year to embrace children from most of the grades. And their hopes have been realized.

# Editorials and Educational News

## ENRICHING SCIENCE TEACHING

A child in the first grade of school once said to her mother "I don't like to go to school."

"Why not," asked her mother in surprise.

"Because you have to sit still so much," said the child.

"But you liked to go to school when you went to nursery school and kindergarten," said her mother.

"Yes, but we were always doing things then," said the child. "Now we just sit and listen to the teacher talk."

The story does not indicate that what the child describes of this particular first grade is typical of all first grades. The story is told because it may indicate that, as children advance from the nursery school to the higher grades above, pupil activity begins to decline.

The project-activity type program occurs less frequently in the Junior High School than in the Elementary School. There may also be a marked decline in pupil activity at the senior high school level. Much of the science program may resolve itself into recitations in which pupils sit and listen to teachers recite lessons. An enriched program in science education will be so planned as to provide *activity*. Learning by doing is the keynote!

In an enriched program provision will be made for enjoying the exploration of science. It may be economical to have biology teachers use microprojectors instead of having pupils use microscopes, but the teacher has most of the fun. Even though pupils may never become expert microscopists, if the pleasure obtained from actual manipulation of the microscope brings enjoyment and understanding of micro-organsims the procedure is excellent.

Organic learning may occur when stimuli are so dynamic that an emotional response takes place. Enrichment of the science program may take place when classroom teachers so organize their procedures that field trips, visual aids, radio broadcasts, etcetera, are used to raise classroom episodes to dramatic and dynamic levels.

Then, too, in an enriched science program the materials of instruction will be organized around numerous problems of personal and social significance. Such a program will be directed towards such functional outcomes as health, conservation-mindedness, orientation to work, safety, and intelligent consumption.

The American Way of Life may be sensed as a permeating factor of an enriched science program. Running, too, through such a program will be numerous applications of the scientific method. Practice in the use of the scientific method should enable pupils to do a better job of thinking.

ARTHUR O. BAKER, *Chairman,*
*Science Curriculum Centers*
*Cleveland, Ohio.*

## THE USE OF NATURE TRAILS

EDITOR'S NOTE: *A type of in-service training which has proven useful in the Cleveland area is described in the following article. The trail committee of the Cleveland Natural Science Club is one of the pioneers in the trail projects.*

A large part of science teaching deals with an interpretation of the out of doors. Teachers practice Dewey's well known phrase "We learn by doing," in many phases of their work, but fail to carry it over to the teaching of science. Natural Science taught from a book, may convey facts to children, but fail to give an inspiration or a love of the outdoors.

One way to develop a love for the outdoors is to be out in it at all seasons of the year, beginning with the first flower of spring (which in the Cleveland region is pepper and salt (Erigenia) found by brushing away the leaves) and watching the procession of flowers through spring, summer and fall. Follow this by observing the various types of seed dispersal provided to perpetuate the species. Winter is not a dull season for there are many green things under the snow—mosses, lichens, liverworts, lycopodium, some ferns, and leaves of mitrewort and hepatica. Winter is an excellent time to learn tree barks and buds. Try a walk in the woods after a fall of soft snow. Snow in the city is usually just a nuisance, but in the woods away from the smoke and dirt it creates a new and clean world and makes one forget sordidness.

Cleveland is fortunate in having a Metropolitan Park System of natural woodland surrounding the city. Four of these park areas have labeled Nature Trails, which afford an opportunity for teachers to read nature rather than books about nature. The signs on the trail give the names of the outstanding flowers and trees along the trail, as well as a few interesting or pertinent facts about them. Other signs help to interpret the geology or ecology of the region, while others may bring out the interesting balance of nature or encourage the observers to be conservationists.

Three of these trails are maintained by the Cleveland Museum of Natural History and the fourth by the Cleveland Natural Science Club. The membership of this club is largely science teachers, who are able to have close contact with

nature at their Lodge, which is located in one of the Metropolitan Parks.

A committee of twenty five members maintain a trail through a section which provides the types of habitats for the whole scale of plant life from algae to seed plants. Two glass covered bulletin boards along the trail, provide an opportunity to further interpret the trail by pictures, specimens and information.

The teachers who work on this trail gain much in both information and inspiration to pass on to their classes. Some teachers bring small groups of children to help with the work and that gives them direct contact with the woods as well as feeling that they are helping in a big project.

In smaller cities and towns where there is no Metropolitan Park System, it might be possible to find a wooded area near enough to the school, where both teacher and pupils could participate in laying out and labeling a trail. I'm sure any teacher would feel well repaid for any effort along this line. It is a chance to work with the real thing rather than just text books and affords healthful outdoor recreation. The more opportunity a class has to participate the more interest and pride can be developed in "Our Trail."

The participation in the interpretation of a Nature Trail can furnish a valuable means of enriching the teacher's scientific background and either directly or indirectly that of her pupils. This conclusion is the result of ten years of personal work on the trail maintained by the Cleveland Natural Science Club.

GRACE CURRY
*Cleveland, Ohio.*

## GARDENING AND ELEMENTARY SCIENCE

For nearly ten years gardening has been an integral part of elementary science in the Cleveland schools. During that time it has consistently grown in teacher and pupil acceptance. At the start, in 1932, about 5,000 pupils enrolled for school and home gardening projects in some 55 schools; in 1940 there were over 18,400 enrolled in 132 schools—all the elementary and all but two of the junior high schools in the system.

Actual gardening projects for pupils to carry on at home or in a school garden tract, are logical and psychological outgrowths of the elementary science instruction. If the latter is truly effective it must instill in the pupils the desire to try out and discover for themselves. While many fields of mechanical science are not suited to child participation on anything like a scale of full responsibility, gardening is ideally adapted to a truly scientific approach by the youngsters who wish to try out for themselves some of the principles of biological science discussed in class. Projects planned from a practical as well as educational standpoint provide for exploring, discovering, creating—experience that enriches character and intellect alike. Full responsibility for true-life situations in plant growing brings the child into contact with reality, on a scale within his physical and mental powers.

The Cleveland elementary gardening projects are all voluntary, but specific. For school tract gardens they are combination vegetable and flower gardens ranging in size from 200 to 300 square feet. On these gardens all work is done under teacher supervision and in regular class groups which continue to meet on a regular schedule all through the vacation period. A small enrollment fee is paid by each child who signs up for a garden; all supplies are furnished and all produce belongs to the children. About 1,100 youngsters participate on three garden tracts aggregating nearly 11 acres.

Home projects include definitely planned garden plots, box gardens, and house plant growing enterprises, for each of which a small enrollment fee is required (usually 5 cents) and used to provide the necessary seeds and plants. The former are put up in special packets for the gardens as planned, by the Templin Bradley Seed Company. Seed collections are assembled, most of the plants grown, and all of the children's supplies prepared for distribution to the schools at West Technical High School greenhouse, the supply center for the Garden Department. Some 78,000 packets of seed, 52,000 garden plants, and 9,000 house plants were distributed for the home projects alone in the spring of 1940.

The regular science teachers in the various schools do the work which makes this whole home project program possible. They distribute the announcement circulars, take the enrollments and fees, give out the supplies delivered to their buildings for those enrolled, visit the garden project children at their homes twice during the summer (for a small extra compensation), conduct a concluding exhibit after school opens in the fall, and give out the certificates and awards. The fact that all this work is voluntary and yet done with positive interest and pleasure in a great majority of the schools, is tangible evidence that the school staffs thoroughly believe in the value of the gardening work for their pupils.

Underlying these voluntary home and school gardening projects are the science units of study which deal with the plant phases of the subject. Two specific units on garden planting and garden care, in fifth and sixth grades respectively, are of definite value to the successful conduct of the garden projects by those who undertake them. Conversely, the gardening is an application and demonstration of many of the fundamentals taught as science rather than gardening, bringing them to life in practical situations within the comprehension of the pupils.

The inclusion of gardening instruction as a part of elementary science seems to be both logical and practical. The training of science teachers is such that only a reasonable amount of specific help is necessary to enable them to do a satisfactory job of instruction in gardening. Most science teachers by inclination are garden-

ers, already interested in the practice as well as the theory. Gardening and natural science seem to be natural concomitants in everyday practice as well as in educational organization.

Looking in the other direction, the school garden is an effective service agency for science instruction. All sorts of illustrative and demonstration material of great value to the science teacher can be supplied from the garden and greenhouse. In Cleveland this has been developed notably, insofar as funds and facilities have been available for organizing and distributing materials.

By proper integration, as the Cleveland organization shows, it is possible for school gardening and science to mutually benefit each other, to the advantage of both pupils and teachers. It is by this means alone that gardening contacts can be brought to all the school population, and at a relatively insignificant cost.

PAUL R. YOUNG
*Supervisor in Charge*
*Department of School Gardens*
*Cleveland Public Schools.*

## INFORMAL EDUCATION IN CLEVELAND'S METROPOLITAN PARKS

The people of Greater Cleveland are fortunate in the possession of over 11,000 acres of park lands, wonderfully rich in natural resources, included within the Cleveland Metropolitan Park System.

In some of these park areas occur fine examples of practically all of the forest types characteristic of the region. There is thus made available for the enjoyment of the people a wealth of natural beauty expressed in such things as trees, wildflowers, ferns, birds, mammals and other animals, and in the fine geological exposures which the park ravines and gorges afford.

Since 1928 the Cleveland Museum of Natural History, in cooperation with the Cleveland Metropolitan Park Board, has engaged in an ever-expanding program of popular nature education in these park reservations. Nature Trails have been set up and operated in widely separated areas. Labeled Wildflower Trails have been made a feature of the early spring season. Early Sunday morning Bird Walks in spring, and Tree Walks, Geology Walks and Mushroom Walks in autumn have attracted many thousands of people.

During the summer, this educational program revolves about three Trailside Museum buildings, each in a different, but characteristic natural environment. Each is dedicated to the popular interpretation of its own surroundings. One of these buildings is in the midst of a climax forest of beech and sugar maple. Another, on the banks of Rocky River, is surrounded by a fine example of the flood-plain forest of northern Ohio. The third occupies a position adjacent to the oak and hickory forest of the drier ridges. Thus the story that each Trailside Museum has to tell, is different from that of the others.

These museums come into active operation in spring with a week-end program devoted to wildflowers, migrating birds, and the awakening vegetation. During the summer they are open daily, each with a resident Trailside Naturalist in charge. In autumn the program is again a week-end affair devoted to forest fruits, falling leaves and nature's preparations for winter. During the winter, at one building, a Sunday afternoon program featuring trees in winter, winter birds, and animal tracks in the snow is maintained.

Trailside talks, Sunday afternoon lectures, children's nature clubs, and guided trips, are regular features of these museum programs. The museum exhibits are all interpretative of the surrounding forests and their bird and animal life.

For the science teacher these Museum programs in the Cleveland Metropolitan Parks offer an exceptional opportunity not only for the acquisition of knowledge but for actual participation in leadership.

In addition to the more or less informal educational program, the Park Naturalist has for five successive years led a course in the Western Reserve University's Summer Session in the Natural History of the Cleveland Region, based largely on field work in the Metropolitan Parks. This class is an excellent example of successful educational cooperation between three important Cleveland agencies—Western Reserve University, The Cleveland Museum of Natural History, and the Cleveland Metropolitan Park Board. Its sessions have always been attractive to science teachers and others who are anxious to increase their familiarity with the natural resources of the region and gain a working knowledge of the ecology of the park forests.

ARTHUR B. WILLIAMS,
*Park Naturalist*
*Cleveland, Ohio.*

## PHOTOGRAPHIC CONTEST

The Fourth Scholastic Salon of Photography of The American Institute Science and Engineering Clubs, exhibited at the American Museum of Natural History in New York City, evoked sincere amazement from Berenice Abbott, well-known photographer who judged the show, as well as from many visiting photographers. They were greatly impressed by the quality of both the technique and ingenuity shown in the two hundred and sixty prints which were accepted.

The youthful entrants, whose ages range from twelve to eighteen, represent schools and clubs from all parts of the country, and as far away as Hawaii. The Salon is divided into two sections, pictorial and scientific, and displays a subject range of great variety, from portrait photography to a highly technical micrograph.

The winner of the Grand Award, for the best picture in the Show, is Norman Paskoff, eighteen years old, of 598 Pine Street, Brooklyn, New York, for his head of a shabby wind-blown little boy, entitled "Billy."

## SUMMER MEETING

The members of the National Council on Elementary Science and other readers of *Science Education* are cordially invited to attend the 1941 convention of the Department of Science Instruction of the N.E.A. next June 30, July 1 and 2 in Boston, Massachusetts.

The theme of the meeting will be "Making Science Instruction More Worthwhile." Speakers, many of them nationally known, will show how this can be done by discussing new instructional techniques, by bringing their listeners up to date in the fields of science, and by revealing important relationships between the contents of science courses and the out-of-school needs of the pupils who takes those courses.

The convention will consist of sessions on the afternoons of June 30, July 1 and 2, and a luncheon in the Somerset Hotel at noon, July 1. Watson Davis will be the luncheon speaker. The convention headquarters of the Department will be in the Somerset Hotel.

For those members of the Department who cannot attend this convention, the 1941 yearbook will contain edited transcripts of the talks, as well as additional material of interest and value to science teachers.

JACK HUDSPETH, *President*
*Austin Public Schools,*
*Austin, Texas.*

## A PROFOUND LOSS TO THE TEACHING OF SCIENCE

Miss Nellie F. Matlock, the retiring secretary-treasurer of the American Nature Study Society and nominee for the presidency of that organization, died January 20th, 1941, at the De Paul Hospital in St. Louis.

Miss Matlock is remembered by her St. Louis friends as a kindergarten teacher at the Laclede School for the last twelve years. Prior to that service she was at the Jackson and Henry Schools of that city. She had a host of loyal friends locally and nationally. She had been for some years identified with the Association of Childhood Education, was a former president of that Association in St. Louis, and planned a number of national programs for that organization along nature study lines. She was a member of the executive board of the St. Louis Grade Teachers' Association and a member of the Ethical Society. She had also been a member of the faculty of the Ernest Thompson Seton Institute, a school of Indian wisdom near Santa Fe, N. M.

As secretary of the American Nature Study Society she was instrumental in establishing and furthering certain scholarships which were open to young people who desired to attend the various summer schools featuring field nature study. Through her efforts the stability of the organization financially and the membership increased substantially. She was always active at the national meetings of the Society and provided an aggressive leadership where this was needed in its national affiliations.

She deemed it desirable to retire from this particular work because of other professional obligations, but in token of her service, a very considerable following of the Society felt that she should be the organization's new president. She was nominated for that position at the annual meeting in Philadelphia less than a month before her death.

She is survived by a brother, Charles Matlock of Springfield, Mo., and leaves a host of friends who recognize the good that she had done.

# Abstracts

## SCIENCE EDUCATION

JOHNSON, PHILIP G. "Making Classroom Charts." *Books in Their Courses* 1:8; April, 1940.

A practical means of making diagrammatic, graphic, representative, and pictorial charts is described in this article.

—C.M.P.

JOHNSON, PHILIP G. "Scanning the Science Horizon." *Books in Their Courses* 1:7–8; January, 1940.

The author lists twelve trends in science teaching which he believes are worthy of an expanded analysis in order to make clear their implications.

—C.M.P.

DAVIS, IRA C. "The Silent Demonstration in Science." *Books in Their Courses* 1:7–8; April, 1940.

The author compares two kinds of demonstrations: teacher-talking demonstration, and silent demonstration. A general procedure for silent demonstration is included, also what "the teacher does" and what "the pupil sees."

—C.M.P.

PALMER, E. LAURENCE. "Waterways in Spring." *Cornell Rural School Leaflet* 33:3–32; March, 1940.

This is the third of a series of six leaflets dealing with the management of parts of New York farms. Phases of the leaflet are: (1) Ponds and lakes, (2) Springs and streams, (3) Marshes and bogs, (4) Fish problems, (5) Water mammals, (6) Water birds, (7) Salamanders and frogs, and (8) snakes and turtles.

—C.M.P.

PALMER, E. LAURENCE, GORDON, EVA L., SCHMIDT, VICTOR E., AND THRUBER, WALTER. "Elementary School Field Experiences in Natural Science." *Cornell Rural School Leaflet* 34:5–48; September, 1940.

This article describes many possible field trips in science. There is a brief description, suggestions of things to do and follow-up activities. A few of the suggested trips are: (1) What significance is there to sounds in autumn? (2) Let's investigate a killing frost, (3) Field study of "evergreen" trees, (4) Field study of an electrical transmission line, (5) Let's take a picture, (6) A visit to an elevated place, (7) Visit to a road cut, (8) Study of an unpainted building, and (9) Visit to a pile of junk.

—C.M.P.

PALMER, E. LAURENCE. "The Finer Side of Life." *Cornell Rural School Leaflet* 34: (not paged); November, 1940.

This Leaflet reflects on the value of a few of our senses, on the appeal of a few places, and on our responsibilities to our associates. On every page is an excellent photograph supplemented by timely, pertinent comment. Major topics are: (1) How to know something, (2) Let's eat, (3) Your nose knows, (4) Let's get rhythm, balance, and timing, (5) Seeing and hearing, (6) High places, (7) The sea, (8) Winter, (9) City and country, (10) Chances missed by many, (11) What is it worth? (12) Man or nature, (13) Get acquainted with your family and your neighbors, and (14) Know your country.

—C.M.P.

PALMER, E. LAURENCE. "You." *Cornell Rural School Leaflet* 34:3–32; January, 1941.

This leaflet is addressed to children and both informingly and entertainingly discusses various members and attributes of the human body. These include: hands, arms, feet, and legs, muscles, bones and joints, skin, nails, and hair, under the skin, the chest and trunk, sensitivity, eyes, the nose and breathing, ears and hearing, the mouth and lips, teeth, inside the mouth, habits and growing up.

—C.M.P.

BERNETTA, SISTER M. "Unit Teaching Material: The Polar Regions." *The Journal of Geography* 39:10–16; January, 1940.

This geography-science unit includes: (1) objectives, (2) approach, (3) pre-test, (4) method, and (5) bibliography. The subject-matter content is divided into eight parts.

—C.M.P.

BAKER, TUNIS. "Science Equipment in Elementary Schools." Reprint from *The Science Counselor*, December, 1940.

This article describes and discusses the series of elementary science units worked out by the author in collaboration with the Chicago Apparatus Company. These units not only furnish the teacher with many science activities and experiments, but also supply all the equipment and apparatus necessary for conducting such activities. Units are "Experiments with Air," "Experiments with Heat," "Experiments with Electricity," "Experiments with Simple Machines,"

and "Experiments with Elements and Compounds."

—C.M.P.

BURNHAM, ARCHER L. "Basic Generalizations in Fourth Grade Geography." *The Journal of Geography* 39: 110–117; March, 1940.

Ninety-nine generalizations for the fourth grade are listed, involving the following nine areas: (1) Shape of the earth, (2) Position of the sun, (3) Land forms, (4) Climate, (5) Water, (6) Food, (7) Clothing, (8) Shelter, and (9) Trade and travel.

—C.M.P.

THOMAS, KATHERINE. "Textiles." *The Grade Teacher* 58: 40–41, 68; June, 1940.

This unit presents teacher's aim, pupils' aims, approach, development, activities, outcome, and bibliography.

—C.M.P.

RIGGS, MARGARET. "A Unit on Soil Conservation." *The Instructor* 49: 18–19, 65, 71; June, 1940.

This is an illustrated unit on soil conservation intended for the middle and upper grades.

—C.M.P.

CARR, BERTHA FRANCES. "Community Life." *The Instructor* 49: 37–46; June, 1940.

Objectives, method, points to emphasize, activities, and bibliography are included. The primary grade unit is entitled "Learning About the Community"; the middle grade unit, "Opportunities for Education and Recreation"; and the upper grade unit, "Work and Protection Offered by a Community."

—C.M.P.

LEWIS, INEZ JOHNSON. "Elementary Science Curriculum." *The Grade Teacher* 58: 62–63, 73, 77; September, 1940.

This is a detailed outline of objectives and content for elementary science in the grammar grades. Six units with problems and activities are included.

—C.M.P.

BACON, ELLA. "The Dairy Cow." *The Grade Teacher* 58: 30; 78–81; September, 1940.

This unit presents: objectives, preparation, outline of study (appearance, food and feeding, home treatment of cows, milking time, care of calves, products obtained from cow, preparation of milk), activities and outcomes.

—C.M.P.

ERPENSTEIN, O. M. "The Sunflower." *The Grade Teacher* 58: 16–17; September, 1940.

This is an illustrated elementary science unit portraying the development and growth of the sunflower from seed to complete flowering.

—C.M.P.

BLOUGH, GLENN O. "How Do We Use Fire and Fuels?" *The Instructor* 49: 45–54; October, 1940.

This illustrated unit presents overview, objectives, problems for supplementary lessons, important meanings to be developed, bibliography, activities, and things to do for three grade levels—primary, middle grades, and upper grades. The primary grade unit is entitled: "How Is Fire Important to Us?"; the middle grades unit, "How Does a Fire Burn?"; and the upper grades unit "How Do We Use Fuels to Heat Our Homes?"

—C.M.P.

WIGTON, ROBERTS K. "We Saw Glass Fruit Jars Being Made." *The Instructor* 49: 60; October, 1940.

This science unit tells about planning a trip through a glass fruit jar plant, the trip, and follow-up activities.

—C.M.P.

GARDNER, MARY. "The First Grade Learn Linear Measure." *The Instructor* 49: 20; October, 1940.

This unit is a series of four lessons on teaching first-grade children the meaning of measurement and how to measure.

—C.M.P.

WALTERMIRE, HELEN M. "Frontiers of Tomorrow." *The Instructor* 49: 22; October, 1940.

This is an upper-grade science unit, dealing with various aspects of science.

—C.M.P.

BOND, J. EDWARD. "Building a Terrarium." *The Instructor* 49: 36, 74; October, 1940.

This illustrated article, suitable for any grade, describes the building of a terrarium, what to use and how to take care of it.

—C.M.P.

VESSEL, M. F. "On Teaching Conservation." *Journal of the National Education Association* 29: 219; October, 1940.

To develop proper attitudes of conservation four specific factors about natural resources should be known: (1) what the local resources are, (2) life span or developmental process of the natural resource, (3) something of the complicated relationships of animals, plants, climate and soils to each other, and (4) the social economic importance of the natural resources.

—C.M.P.

SYMPOSIUM. "What Is Chemistry? What Is Physics? What Is Biology? What Is Household Science?" *The Science Leaflet* 14: 5–24, September 12, 1940.

This issue has the above four major topics headings with other closely related articles as sub-topics.

—C.M.P.

WACHTER, WALTER. "Simple But Effective Demonstrations." *The Science Classroom* 20: 1; October, 1940.

Four experiments are described in this article: (1) the howling tube, (2) soda straw musical pipe, (3) test tube orchestra, and (4) center of gravity.

—C.M.P.

ANONYMOUS. "Home Laboratory Tests with Light." *Popular Science Monthly* 137: 202–203; October, 1940.

The home laboratory tests described, include the making of a telescope, making a microscope, and experiments with a reading glass.

—C.M.P.

EISELEN, ELIZABETH. "The Technique of Exhibits." *The Journal of Geography* 39: 320? 322; November, 1940.

Among many factors to be taken into consideration are: (1) what are the results sought? (2) who are the people it is to reach? (3) selection of site, (4) content and presentation of content—artistic presentation and pleasing arrangement, easy to see, adequate lighting, time factor, and (5) exhibit from the spectator's standpoint.

—C.M.P.

MOSS, MARY E. "A Unit on Animals." *The Instructor* 50: 20, 73; November, 1940.

This is an illustrated science unit intended for the primary and middle grades.

—C.M.P.

WALTERMIRE, HELEN M. "Power and Human Progress." *The Instructor* 50: 21, 77; November, 1940.

This unit for the upper grades includes objectives, approaches, excursions, thought questions, outline for study and activities.

—C.M.P.

KELLY, NORMAN R. "We Visit Our Cold Storage Plant." *The Instructor* 50: 61; November, 1940.

This is an upper-grade science unit. Classroom preparation, objectives, tour through the plant, activities, correlations, and values of the trip are included.

—C.M.P.

GOLDEN, EMMA. "A Unit on an Aquarium." *The Instructor* 50: 47, 70; December, 1940.

This practical unit intended for the primary grades includes the following: (1) approach, (2) teacher's aims, (3) children's aims, (4) securing and setting up the aquarium, (5) studying the balanced aquarium, (6) caring for the aquarium, (7) performing simple scientific experiments, (8) correlated activities, and (9) outcomes in addition to realization of original aims.

—C.M.P.

ANONYMOUS. "Science Stunts." *Popular Science Monthly* 138: 188–189; January, 1941.

The following science experiments are described: (1) model hot-water plant, (2) oil in water wastes fuel, (3) soot adds to fuel bill, (4) test for humidity, and (5) coffee-can furnace.

—C.M.P.

BRANLEY, FRANKLYN M. AND LEE, HERBERT. "Initiating the Elementary Science Program." *The Grade Teacher* 58: 50, 68–69; January, 1941.

This is an article intended for the upper intermediate and grammar grades. Several reasons are given for teaching science in the elementary school. Suggestions are given for teaching a unit on air.

—C.M.P.

SALISBURY, DOUGLAS. "Winter Field Trips." *The American Biology Teacher* 3: 124–125; January, 1941.

In this short article the author makes numerous suggestions for biology field trips in winter—along the river, in the woods and field, and in ponds and swamps.

—C.M.P.

BREUKELMAN, JOHN. "The Aquarium as a Teaching Device." *The American Biology Teacher* 3: 133–135; January, 1941.

Phases of an aquarium considered in this article include: (1) Building an Aquarium, (2) Stocking the Aquarium, (3) Maintaining a Supply of Organisms, (4) The Study of Structure, (5) Growth and Development, (6) Food Manufacture, (7) Feeding Habits of Animals, and (8) Respiration.

—C.M.P.

AVIGNE, FRANCES HUBBELL. "A Unit on Time." *The Instructor* 50: 13; January, 1941.

This unit is intended for the primary grades and includes approach, procedure, correlations, outcomes, and bibliography.

—C.M.P.

BLOUGH, GLENN O. "How Does the Surface of the Earth Change?" *The Instructor* 50: 45–54; January, 1941.

This elementary science unit intended for three levels in the elementary grades, includes for each level: overview, objectives, important meanings to be developed, activities, and bibliography. The primary grade unit is entitled, "What Is the Surface of the Earth Like?", the middle grade unit, "How Do the Earth's Surface Materials Travel?", and the upper grade unit, "How Is the Earth's Surface Built Up?"

—C.M.P.

BUHR, GERALDINE, AND GILBERT, DOROTHY. "Wild Animals." *The Grade Teacher* 58: 32, 78–79; January, 1941.

This unit on animals includes objectives, activities, test, and teacher references. Animals con-

sidered are the lion, giraffe, elephant, tiger, bear, camel, and monkey.

—C.M.P.

MEISTER, MORRIS. "Clip and File." *The Science Classroom* 20:1; February, 1941.

In this article, the author calls attention to the advantages of pupils clipping and filing science articles.

—C.M.P.

GREEN, MABEL A. "We Visited a Flour Mill." *The Instructor* 50:63; February, 1941.

This elementary science unit includes: approach, aims, classroom preparation, visit to the mill, activities, values of the trips, and outgrowths.

—C.M.P.

BRANLEY, FRANKLYN, AND LEE, HERBERT. "Study of Water." *The Grade Teacher* 58:49, 75; February, 1941.

This illustrated, elementary-science unit, intended for the upper, intermediate and grammar grades, outlines several appropriate activities for pupils.

—C.M.P.

LINDSJO, ELEANOR. "Lumber and Its Use." *The Instructor* 51:45–54; February, 1941.

This illustrated unit presents: overview, important concepts and objectives, approaches, pupil and teacher bibliography, things to do, and activities. The primary grade unit is entitled, "Trees Give Us Lumber," the middle grades unit, "Our Forests as Raw Material," and the upper grades unit, "Modern Wood Industries."

—C.M.P.

MEISTER, MORRIS. "For Homework, Do These." *The Science Classroom* 20:1; March, 1941.

This article describes a series of experiments suitable for homework.

—C.M.P.

ANONYMOUS "Science Stunts." *Popular Science Monthly* 138:195–197; March, 1941.

The following science stunts are illustrated and explained: "Atomizer and Spray Gun," "How Sink Traps Work," "Saving Ice Spoils Food," "Pressure Cooker," and "Fireless Cooker."

—C.M.P.

# Book Reviews

## TEACHING OF SCIENCE

CRAIG, GERALD S. *Science for the Elementary School Teacher.* Boston: Ginn and Company, 1940. 540 p. $3.00.

Part One is a brief presentation of trends in elementary school science, and a guiding philosophy. This is implemented throughout the rest of the book through the use of many specific illustrations from classroom situations. Although predominantly a presentation of science background, the suggestions for using the material in elementary school teaching are combined with the content-material in a most useful way. The material is presented in the form of many simple generalizations, each of which is in turn supported by descriptive material which is simply and clearly written. Skillfully woven into this basic subject-matter are the suggestions for the teacher which show the purpose for which the content may be used and ways in which it may be presented in the classroom. Part II, under the title, "The Earth and the Universe," covers simple astronomical and geological concepts, something of the elements making up the earth, and the atmosphere. Part III is entitled "The Life of the Earth" and Part IV, "The Energy of the Universe." Part V presents a suggested sequence of meanings in science, and this outline, or course of study, is keyed to the text by page numbers. The brief chapter bibliographies are well selected and should prove helpful for the teacher to read.

—O. E. Underhill.

VINAL, WILLIAM GOULD. *Nature Recreation.* New York: McGraw-Hill Book Company, 1940. 322 p. $3.00.

The subtitle of this book aptly describes its purpose *Group Guidance for the Out of Doors.* And probably no one is as well qualified to write such a book as the author. This type of work has long been his major interest and activity, both during his many years at Western Reserve University and also more recently at Massachusetts State College. He has had a long, rich, varied experience as leader and director of summer camps.

There is a need for an authoritative discussion of leadership in the out-of-doors. This book most ably supplies that need. It is a practical guide for out-of-doors group leaders. Seemingly every problem and question relating to camp work and nature education has been discussed. Science teachers will find this a most excellent book to read, especially if they conduct field trips of any kind. And if they do not now conduct such trips, this book may entice them into doing so!

—C.M.P.

CUNNINGHAM, H. A. *Material Facilities Needed in the Training of Intermediate Grade Teachers in Science.* New York: Bureau of Publications, Teachers College, Columbia University, 1940. 162 p. $2.00.

This doctoral dissertation presents important data regarding the desirable material facilities needed in training intermediate grade teachers in science. Primary sources of data include: (1) a curriculum analysis, (2) an actual study of the material facilities used in seventeen teachers colleges in the training of intermediate-grade teachers in science, and (3) a study of the material actually used in teaching intermediate-grade science in the schools. Secondary sources of data include: (1) scientific studies in the field of sience education, (2) findings of the biological and physical sciences, and (3) opinions of experts in the field of laboratory construction.

Many valuable suggestions for teachers of elementary science methods courses are included. Detailed suggestions as to materials and room layouts are presented. Teachers fortunate enough to be in a position of contemplating, or advising in, the construction of a new elementary science room will find this treatise most helpful.

One minor criticism of the study might be made regarding the lack of up-to-dateness and completeness of the bibliography.

—C.M.P.

WEBB, HANOR A. "The High School Science Library for 1939–40." Reprint from *Peabody Journal of Education,* November, 1940.

This is Professor Webb's sixteenth annual publication of "The High School Science Library." As usual the books are placed in certain price groups: the $10 list, the $25 list, the $50 list, the $100 list, the $200 list, and the over $200 list. The books are listed according to the title under certain field classifications. The author, price, publisher, and a brief annotation is given for each book.

—C.M.P.

SYMPOSIUM. *1939 Proceedings of N. E. A. Department of Science Instruction.* Easton, Pennsylvania: James Aelfric, 801 Spring Garden Street, 1939. 223 p. $0.50.

This is the report of 1939 San Francisco meeting of the N. E. A. Department of Science

Instruction. The general theme was: How Science Fulfills the Needs of Boys and Girls. Contributions are included from the following science areas: elementary school, junior high school, senior high school, and junior college. There are also some general papers and brief reports from subcommittee chairmen of the National Committee on Science Teaching.

—C.M.P.

MEMBERS OF THE FACULTY OF THE LABORATORY SCHOOLS OF THE UNIVERSITY OF CHICAGO. *Science Instruction in Elementary and High-School Grades.* Chicago: Department of Education of the University of Chicago, 1939. 232 p. $1.75.

The science curriculum of the Laboratory Schools of the University of Chicago has had a long and continuous development, starting as early as 1900, four years after the Elementary School was started. The present monograph is largely the work of John C. Mayfield, Bertha M. Parker, and Glenn O. Blough.

The monograph presents an overview of the curriculum and content of the science courses; science experiences and procedures in the kindergarten-primary grades; science experiences and procedures in the intermediate grades; program, methods, procedures, and content of courses in the high school; the two-year general course in the physical science, and the two-year general course in biological science. Outlines of typical units on each of these levels are presented. Lists of the other units are included.

—C.M.P.

OLSON, OVE S. *Methods of Teaching High School Biology.* Minneapolis: Burgess Publishing Company, 1940. 52 p. $1.25.

This is a revision of a syllabus first appearing in 1933. The outline is built around 17 major problems. Numerous questions under each problem for which are cited many specific cross-references constitute the major part of the syllabus. A student's ability to adequately answer these questions would sincerely assure him of a thorough background of knowledge of techniques of teaching secondary biology.

The following problems are included: "Philosophy of, and Objectives in High School Biology," "The Psychology of the Teaching of Biology," "Content of the Course of Study in High School Biology," "Methods of Class Procedure," "Laboratory Equipment for the Teaching of High School Biology," "Laboratory Methods in High School Biology," "Choice of Laboratory Work in Biology," "Use of Excursions and Field Trips," "Visual Aids and Radio in Biology," "Motivation in the Teaching of Biology," "Biographical Study of Major Biologists," "Library Work in Connection with the High School Biology Course," "Provisions for Individual Differences," "Standards of Achievement and the Measurement of Teaching Efficiency," "Choice and Use of Texts," "Preparation of the Biology Teacher," and "Lesson Planning in High School Biology." —C.M.P.

SCHWARTZ, JULIUS. *Adventures in Biology.* Brooklyn: (Grover Cleveland High School). New York Association of Biology Teachers, 1940. 101 p. $0.50.

This second edition constitutes a thorough revision. Many new projects have been added, several old ones entirely discarded, and many old ones have been rewritten. There are 265 projects, several of which were written by students. Most of the projects are found in one of the following groups: "Our Plant and Animal Environment," "Nutrition," "Growth," "The Responses of Living Things," "Reproduction," "Heredity, Variation and Evolution," "Bacteria and Health," and "Value of Plants and Animals to Man." There is also a most useful bibliography.

Every biology and general science teacher should have this publication which promises to serve a most useful function in the development of better science teaching in the biological sciences. —C.M.P.

ANONYMOUS. *Living Specimens in the School Laboratory.* Chicago: General Biological Supply House, 1940. 93 p. $1.00.

Science teachers will surely welcome this manual of directions for the care and maintenance of the more commonly studied laboratory animals. One of the most noteworthy trends in biology teaching during the past ten years has been the greatly increased use of living specimens. This is because it is becoming generally recognized as very effective teaching and also because living specimens are now much more readily available at all reasons of the year.

This manual describes many living specimens suitable for the classroom: description, habits, collecting, keeping, food habits, and so on.

An appendix describes and tells how to maintain a balanced fresh-water aquarium, a terrarium, foods, equipment for the care of living specimens, and an especially useful condensed outline for the care of living specimens in the school laboratory.

—C.M.P.

ANONYMOUS. *Free and Inexpensive Educational Materials.* Chicago: Quarrie Reference Library (35 East Wacker Drive). 1939. 120 p. $5.00.

Science teachers — elementary, junior high school, secondary and science methods teachers —will find this an excellent book. There is listed so much free and inexpensive material that the cost of the book is a small item. There is a general classification of materials that makes for convenience in using the book. For each material there is a brief description, price (if any), and the name and address of the concern from which it may be obtained. When one con-

siders the rich visual material available for the mere asking, or at a nominal cost, and the many completely or almost completely barren science classrooms, one wonders just where the fault lies. Are science teachers too indolent to be worthy of their job or are the individuals who taught these science teachers in college unacquainted with instructional materials? Regardless of whose fault it is, it represents a condition that could be easily corrected. The teacher who has no funds available should make liberal use of the service of this publication.

—C.M.P.

COOK, DOROTHY E. and RAHBEK-SMITH, EVA. *Second Edition Educational Film Catalog.* New York: The H. W. Wilson Co., 1939. 332 p. $4.00.

This book is accompanied by a 39-page, April, 1940, supplement. More than 2500 selected nontheatrical films are classified by title and subject. Quarterly supplements are planned to keep the list up-to-date. Information given includes title, length, width, sound or silent, safety stock or not, sale or rental price and authorized distributor. Each film is reviewed. It is a valuable piece of work well done.

—W.G.W.

BOND, AUSTIN D. *An Experiment in the Teaching of Genetics.* New York: Bureau of Publications, Teachers College, Columbia University, 1940. 99 p. $1.85.

At Western Washington College of Education two units were taught, one to an experimental group of 90 students, one to a control group of 104 students. Each unit occupied fifteen 50-minute periods. The author taught both units. Both groups read three chapters from Plunkett's *Elements of Biology*, and I-VI in Popenoe and Johnson's *Applied Eugenics*. The control group was taught as one would customarily teach a unit on genetics. Both groups had demonstrations of the mitosis and meosis (projection microscope) of ordinary and sex-linked heritance with living fruit flies.

The experimental group "transcended the ordinary boundaries of subject matter in genetics, drawing from such fields as antropology, economics, the history of migrations of peoples, racial problems and psychology." It studied "the biological background of racial differences and similarities" in order that the instruction might "result in greater tolerance for and understanding of peoples whose ancestries differ from those of the students concerned." In other words by using human racial characteristics as subject matter for the study of genetics it was hoped to develop an appreciation of the brotherhood of man as well as ability "to apply principles in the field of heredity." The statistical evidence seems to show that this was accomplished and that there also resulted "a decrease in acceptance of certain common superstitions significantly greater in the experimental group than in the control." And all in three weeks! It is suggested that further investigation is needed to see if the differences are permanent and result in changes of behavior.

—E.R.D.

## GENERAL EDUCATION

ELSBREE, WILLARD S. *The American Teacher.* New York: American Book Company, 1939. 566 p. $2.75.

Many comprehensive and excellent histories of American education have been written, stressing various philosophies, modifications in organization and administration of public schools, curriculum changes, and school legislation. Strangely enough in these comprehensive treatises the classroom teachers have received very little attention. The author states that it is his belief no one has ever done this. This book is an attempt to tell the story of the public-school teacher in America during the last three centuries. Thus the book should be of interest and value to all educational workers, present and prospective.

The book is divided into three parts: (1) the colonial schoolmaster, (2) the public-school teacher during the early years of the republic, and (3) the emergence of the professional teacher. Altogether Professor Elsbree has done an excellent job and performed a valuable service. You will have a better appreciation and understanding of your vocation after reading this book. This is one history of education the reviewer thoroughly enjoyed and he recommends it to you.

—C.M.P.

BRUECKNER, LEO J., et al. *The Changing Elementary School.* New York: Inor Publishing Company, 1939. 388 p. $3.50.

The *Regents' Inquiry* into the character and cost of public education in the State of New York has been the center of educational discussions for more than a year. Most of the *Regents' Inquiry* is concerned with secondary education. This is the section of the report which deals with the problems of the elementary school.

There are two major divisions. The first deals with the survey material, as it was collected from a selected group of elementary schools, and with the recommendations of the surveying committee. The second part consists of special recommendations of specialists for certain major areas of school instruction. Those treated are health education, reading instruction, social studies, arithmetic, English, and art. The

recommendations appearing as a summary of part one are by far the most significant parts of the report.

All people interested in education should read the recommendations on the elementary school curriculum and on classroom instruction. These are equally pertinent for conservative and progressive. The recommendations are remarkably free from bias. They are to be commended for essential sanity in the midst of a much confused educational picture.

Secondary-school teachers may well read the sections recommended above and especially the parts of the report dealing with relationships between the elementary and secondary schools and with the problem of promotion of pupils from grade schools to high schools.

—R.K.W.

COMMITTEE REPORT. *Newer Instructional Practices of Promise.* Washington: The Department of Supervisors and Directors of Instruction of the National Education Association, 1940. 379 p.

In this Twelfth Yearbook are presented various educational practices, reinforced by elaborate illustrative materials which teachers and supervisors have found of value in enriching youth's educational experience. A few of the chapter headings are: "A Summary and Implication of Newer Trends," "Renewed Emphasis on Democratic Social Living," "Wider Utilization of the Environment," "Procedure for Developing an Integrative Curriculum," "The Use of the School Library," "The Use of Newer Types of Instructional Material," "Supervisory Techniques Adapted to Newer Teaching Practices," and "Evaluation of Newer Instructional Materials." The chapter entitled "New Emphasis on the Understanding of Science" was written by Gladys L. Potter.

—C.M.P.

SYMPOSIUM. *Enriching the Curriculum for the Elementary-School Child.* Washington: Department of Elementary School Principals of the National Education Association, 1939. 704 p. $2.00.

This is the Eighteenth Yearbook of the department. The nature and significance of curriculum enrichment is discussed by Hollis L. Caswell. Other chapter headings, each having numerous contributors, are: (1) "Approaches to Curriculum Enrichment," (2) "Making Learning Concrete and Purposeful," (3) "Developing Appreciations and Creative Abilities," (4) "Enrichment Through School Materials and Equipment," (5) "Making Use of Community Resources," (6) "Measurement and Guidance in Relation to Curriculum Enrichment," and (7) "Vitalizing the Curriculum under Various Types of School Organizations."

—C.M.P.

STODDARD, GEORGE D., Chairman (and CARMICHAEL, FREEMAN, GOODENOUGH, HOLLINGWORTH, JONES, TERMAN, WELLMAN). Thirty-ninth Yearbook, National Society for the Study of Education. *Intelligence: Its Nature and Nurture.* Bloomington, Ill.: Public School Publishing Company, 1940. Part I, Comparative and Critical Exposition. 471 p. $2.25.

The Society has published several yearbooks that have dealt with "the nature and use of tests of intelligence and the relative contributions of heredity and environment of the making of adult mentality." It was hoped that in this one the committee could come to an agreement so as to make recommendations in regard to the social and educational implications of the studies thus far made. But "it is the editor's own opinion at least that the discussion—in 1940 is just as controversial as it was in 1928—more so indeed."

Part I is written by members of the committee and by contributors working under their immediate supervision. It seems particularly valuable, for it critically examines earlier studies that have come to contradictory conclusions to see wherein the methods have been faulty or the materials inadequate. The whole matter is much more complex than was at first realized. This volume discloses many imperfections in the earlier studies and indicates the better techniques and the added lines of investigation that need to be followed to arrive at settled principles upon which all will agree. It marks a distinct forward step and that a large one. But investigators in this field must heed its cautions, otherwise more studies will pile up with unreliable conclusions.

—E.R.D.

## SCIENCE REFERENCE BOOKS

LORD, EUGENE HODGDON. *Experimenting at Home with the Wonders of Science.* New York: D. Appleton-Century Company, 1940. 243 p. $2.00.

In this book the author attempts to put into writing the thrill, zeal, and liveliness that he felt as a boy performing similar experiments. At present he is a teacher of physics and general science at the Boston Latin School. Nearly a hundred interesting experiments in physics, chemistry, and electricity are presented. Each of the experiments can be performed with the simplest of materials. The group and number of experiment are as follows: (1) doing things with air and air pressure—11, (2) tricks with water and water pressure—6, (3) doing things with heat and combustion—7, (4) doing things with light—5, (5) tricks with common things—6, (6) interesting changes in common substances—6, (7), some useful chemical changes—7, (8)

making useful gases—8, (9) chemical magic—11, (10) home-made fireworks—9, (11) creating electricity by friction—4, (12) batteries and the electric current—7, (13) magnetism at work—3, and (14) making and using electrical and magnetic devices—7. —C.M.P.

YATES, RAYMOND F. *Science with Simple Things.* New York: D. Appleton-Century Company, 1940. 245 p. $2.50.

Many fascinating and interesting experiments are described in this book, using only materials which can be located easily around the average home. This volume is devoted entirely to the world around us, and thus enables the young experimenter to become better acquainted with his physical environment.

Each subject is presented as if the reader had no previous knowledge of it, and is made more understandable by experiments which are carefully described. Chapters include those on energy, heat, air, sound, liquids, light, electricity, and weather.

The young scientist of the secondary school will find this a helpful guide for his home experimenting. The book is illustrated by numerous photographs. It might be criticized in that words are sometimes used in explaining experiments that are not usually found in the vocabularies of secondary school boys and girls.

—Roy V. Maneval.

FREEMAN, IRA M. *Invitation to Experiment.* New York: E. P. Dutton, 1940. 238 p. $2.50.

Anyone reading this book, whether he chooses to perform the experiments or not, is certain to find stimulating knowledge concerning the stuff of the world, mechanics, matters of gravity, molecules, electricity, shadows and reflections, and the light beyond.

The author concludes the book with the statement: "It may disappoint you to end the book with something that is not understood, but perhaps that's a good idea after all. Undoubtedly, nature will always be a step ahead of our understanding. The surest road to such an understanding lies over the firm ground of experimenting."

Although Freeman's work is bound up with Relativity and the Quantum Theory, he is intensely interested in the interpretation of science and knows how to interpret it in a readable and persuasive way. This is a book written for serious, inquisitive people. The fine photographs which illustrate the book are interspersed with clever line drawings by Ira and Mae Freeman.

—Greta Oppe.

KENLY, JULIE CLOSSON. *Voices from the Grass.* New York: D. Appleton-Century Company, 1940. 248 p. $2.00.

This is a popularized book on insect life, packed with interesting accounts of the fascinating activities of many different insects, as well as with interpretive life histories of particular insects at considerable length. The work of insects in solving what are major human problems of today: in building, manufacturing, transportation, hygiene, defense, and government is described in detail. In vivid style, Mrs. Kenly makes the life of the grasshopper, the doodlebug, the termite, the firefly, the cricket, the locust, the ant interesting not only to the adult but to young readers of junior and senior high school age. Mrs. Kenly has had opportunity to study insects in every section of the country. Her material is easily understandable and her interpretation of insect behavior very illuminating. The illustrations consist of striking full-page pen and ink drawings.

—Lois M. Shoemaker.

WRITER'S PROGRAM OF THE W.P.A. *Children's Science Series.* Chicago: Albert Whitman and Company, 1940. 48 p. $0.50 each.

This is a group of science readers compiled by workers of the Writer's Program of the W.P.A. in the Commonwealth of Pennsylvania. Eighteen booklets have been published and 12 more are listed to come in 1941. Some of the 30 titles are: Warships, Aircraft, Trains Going By, Light of the World, Gold, Money, Salmon, Life in the Ant Hill. The books have an entertaining story—telling style, and have been checked for science accuracy and proper vocabulary. The art work, diagrams, and drawings are good but on the whole the color pictures are not of a grade one would expect in a book which lists at this price. The general impressions one gets is that of the 10-cent store booklet. Correlation between text and picture is not always made. The diagram of the "Tree Money of Malacca" attracts one's attention. No mention of it is made in the text. This leads to disappointment. In the opinion of the reviewer, the price is too high for the quality of the make up and the texts deserve the wider use that they could get at a lower price. —W.G.W.

DUNCAN, MARION. *On the Farm.* Philadelphia: David McKay Company, 1940. 40 p. $0.50.

This is a photographic picture book of the lives of two boys, Frank and Skip, who live on a farm in Peaceful Valley, Wisconsin. Many pictures show the boys with their pets—little calves, colts, lambs, pigs, kittens, goats, ducks, and chickens. Considerable textual material accompanies the photographs. This is an excellent supplementary reader for the intermediate grades.

—C.M.P.

HOLME, BRYON. *A Book of Animals.* New York: The Studio Publications, Inc., 1940. 96 p. $2.00.

There is a collection of over 100 very appealing and attractive photographs and drawings of animals—mostly familiar friends, but with several less known as well. Foremost artists and photographers have contributed to this collection. Sectional contents are as follows: Animal

expression, cats, dogs, horses, on the farm, a few birds, and at the zoo. Interesting comments accompany many of the photographs. The pictures will appeal to all grade levels, and the commentary material may be read by upper grade and junior high school levels.

—C.M.P.

HUNGERFORD, EDWARD. *Locomotives On Parade,* New York: Thomas Y. Crowell Company, 1940. 236 p. $2.50.

*Locomotives On Parade* is in a very real sense the story of the development of the United States. Railroads probably served as the greatest influence in making us a unified nation. Without this transportation system our industrial and economic life could not have been developed and coordinated to the extent that it has been. Many areas would have been and many probably would still be isolated areas. The author, an authority on railroads and locomotives, had written a fascinating, romantic story. What boy has not dreamed of some day running a real locomotive of his own! All such boys will like this book with its many interesting stories, anecdotes and fine illustrations. Reading this book one gains the impression that locomotives have not only had a glorious past, but will have a glorious future as well.

—C.M.P.

YALE, JONATHAN. *Story Pictures of Clothing, Shelter, and Tools.* Chicago: Beckley-Cardy Company, 1939. 277 p. $0.92.

This book is intended for grades three and four. There are five major topics: (1) the things we need most, (2) clothing and shelter of the early people, (3) people of today who live as the early men did, (4) the clothes we wear, and (5) the shelters in which we live.

The content of the books seems to be well selected and the illustrations are apt. The vocabulary may be difficult for some third and fourth graders and should have been checked against one or two of the better vocabulary lists for these grades. For this reason the book may be equally or better suited for the fifth grade.

—C.M.P.

BAKER, R. RAY. *So That's Chemistry.* The Reilly and Lee Company, 1940. 128 p. $1.00.

To youngsters of grade and high school age who want to know about things and to teachers and parents who seek to answer their questions this second volume of "Bobby and the Old Professor" is a happy solution. Although it is a second book in a series, it can be used quite independently of the other. On the surface, the educational value seems only incidental, but the facts of chemistry are presented in such an understandable language that it will render a fine service to grown-ups as well as to children. It can help many readers, both young and old, to acquire an interest in chemistry. The book opens with a description of "Khem," the land of chemistry, and some information concerning the ninety-two elements. This is followed by a discussion of the question, "What is smoke?", or "Coal Made by a Squeeze." You may read about the "Salt of the Earth," iron and steel, air, water, dry ice, "Silk without Worms," glass, rubber, and dyes. You are taken inside of the atom, into solids, liquids, and gases and are taught the principles surrounding the electric ice box as well as what is an acid and what is an alkali. Mr. Baker is to be commended for putting into book form these science adventures which originally appeared as articles in newspapers.

—Greta Oppe.

KAUFFMAN, ERLE. *Kingdom of the Trees.* Chicago: Reilly and Lee Company, 1940. 128 p. $2.00.

Here is a book largely in dialog style, giving information about trees in the conversations between Betty, Ben and their forester uncle. There are 67 excellent black and white drawings portraying the trees. Anyone from 8 years on at all interested in nature will enjoy this book. Six pages at the end offer a key for recognizing trees. This is a valuable addition to the book.

—W.G.W.

HARTNACK, HUGO. *202 Common Household Pests.* Chicago, Illinois: Hartnack Publishing Company, 1939. 319 p. $3.75.

The British Imperial Institute of Entomology in its monthly review of the world's entomological publications describes Dr. Hartnack's book as "Eminently readable, planned and illustrated in an original manner." The illustrations are excellent, many of them being the work of foreign entomologists. These illustrations together with the quaint miniature cartoons make it more than a book on common household pests for the professional exterminator. Even the layman will find it interesting reading. Such a book makes it possible for the layman to inform himself. The final chapters are full of information which the general public should have.

Dr. Hartnack points out serious, political injustices, and practices limiting the proper control of pests. His point of view is that all life is competitive and suggests that man remove the materials which attract pests and vermin, and that he apply a knowledge of their habits when constructing, to build them out. For this reason he strives to educate his readers to recognize pests by describing essential facts concerning life history, habits, foods and control measures.

In the foreword Dr. Hartnack offers two criteria to the critic for judging his book: (1) Does it give worthwhile information and does it make information that is already available more usable? (2) Does the work stimulate thinking about the solution of the problem? When we remember that information concerning household pests comes largely from Government and State bulletins, and limited as these must be, any book giving information readily available to an archi-

tect, a property owner, a student or an exterminator is bound to be worthwhile, and when humorous little sketches enliven the pages, the average reader is not lost in the maze of scientific facts which he needs to know. The very fact that initiative must come from the individual to map out a program of control, a book such as this should "goad" the reader to think about the solution of his own household pest problem. There is need for organized effort but a greater need for education. Dr. Hartnack's presentation is such a stimulating departure from the usual treatment of such a subject that it ought to have popular appeal.

—Greta Oppe.

KOEPPE, CLARENCE E., AND RIDGLEY, DOUGLAS C. *Weather and Climate.* Bloomington, Ill.: McKnight and McKnight, 1939. 135 p. $0.80.

This is a workbook for first year college geography. The course includes 15 main topics. Each topic is covered briefly by textual matter, followed by a series of exercises on the text. "Problems for Further Study" are suggested in each case. Wherever needed outline spaces and maps are included for student records. Specific references to nine other books are given for each of the topics besides a general list of books on weather and climate. We believe this will be a very helpful aid in the study of weather and climate. It includes the new ideas of polar front and air mass analysis.

—W.G.W.

GAER, JOSEPH. *Men and Trees.* New York: Harcourt, Brace and Company, 1939. 118 p. $1.00.

Many problems in the high school social studies and science classes involve conservation. This book from the National Problems Series gives excellent source material on forest conservation. It deals extensively with the work of the United States Forest Service. The information given is in a form that can be easily understood by the high school student.

Twenty-four pages of photographic illustrations are found in the book. One section gives a list of forestry terms and their meanings. Another section gives the location and size of our national forests. Anyone teaching conservation of natural resources in secondary schools should obtain one or more copies of this book. The subjects discussed are the forest ranger and his work, the many uses of wood, the effect of trees on soil erosion, diseases of trees, erosion in China, dust storms in America, how the nation can save her trees, and the research activities of the Forest Service.

—Roy V. Maneval.

GAER, JOSEPH. *Fair and Warmer.* New York: Harcourt, Brace and Company, 1939. 137 p. $1.00.

*Fair and Warmer* is a book presenting the great problem of weather forecasting and the work of the U. S. Weather Bureau. A description of weather and weather knowledge in weather forecasting as well as the work of the Weather Bureau as it serves more people to a greater or lesser degree than any other branch of our government, are the chief concern of this fine book. Perhaps the most distinctive features of the book are its purpose and its method of presentation. It belongs to the National Problem Series, a series which confines itself to national problems related to the conservation of natural and human resources, each book focusing attention upon one major problem. The major portion of each book is devoted to the social aspect of the problem and the government's part in the solution and control of that problem, the government being treated not as an organization apart from the people but rather as a service agency of the people. Our democratic way demands a well-informed, educated citizen, and this book offers an excellent opportunity to know the basic whys and the administrative structure of that governmental bureau which handles that unfriendly, unpredictable force, the weather. Since the weather is always news, the book should have wide appeal inside the schoolroom where it may serve as a constructive project or to the layman who needs to understand because weather concerns everybody. The book concludes with a glossary of meteorological terms and an explanation of common weather instruments. The illustrations are authentic and the format very attractive.

—Greta Oppe.

BOTLEY, C. M. *The Air and Its Mysteries.* New York: D. Appleton-Century Company, 1940. 302 p. $3.00.

This is the most comprehensive exposition of the air and weather that has appeared in recent years, and is equally meritorious as two or three similar works of a decade or less ago. The author, a noted English scientist, writes in a clear, vivid, attention-securing style. This American edition was arranged by Professor Hanor A. Webb, Professor at George Peabody College for Teachers. Professor Webb has added additional information and illustrations pertinent for American readers. *The Air and Its Mysteries* is a Scientific Book Club selection.

Science teachers and students will find this an enjoyable book. It is recommended for the high school science bookshelf and as supplementary reading in general science and survey courses.

—C.M.P.

FURNAS, C. C. *The Storehouse of Civilization.* New York: Bureau of Publications, Teachers College, Columbia University, 1939. 562 p. $3.25.

The cover of this book advertises it as one of the basic science books in "The Science in Modern Living Series." The reviewer was unprepared therefore to encounter such topics as

Monopolieo (p. 219), Unemployment (p. 437), the Tariff Walls (p. 543). He looked a second time to make sure it is a Natural Science Series, not a Social Science Series.

The author says "No subject can be grasped in a comprehensive way unless attention is kept centered on the broad principles of order formulated by scientists" (p. 231). Yet the book seems to be concerned with industrial processes, not with basic principles. It treats such topics as "Methods of Mining," "The Open Hearth Process of Making Steel," "How Long Our Gasoline Supply Will Last," "Breaking the Brazilian Monopoly on Rubber."

This does not imply that the book lacks interest. It is full of information. Its valuable statistics are presented in many striking graphs. Nearly a third of it, Chapter X, "Social Implications," gives the author's reactions to the facts he presents and the trends as he sees them. It seems opinionated rather than judiciously scientific. For instance he says "After 1929, the total productivity in goods and services went discouragingly downward. This was caused by widespread unemployment." Yet while this productivity rose forty per cent, 1920 to 1928, unemployment more than doubled. Unemployment rose (table p. 412) during 1932, 1933, while production steadily increased (graph p. 411).

—E.R.D.

FITZPATRICK, FREDERICK L. *The Control of Organisms.* New York: Bureau of Publications, Teachers College, Columbia University, 1940. 334 p. $2.75.

This is the third volume of the Bureau of Educational Research in Science. Like the two preceding volumes, *Life and Environment* and *The Storehouse of Civilization,* this volume emphasizes conservation and the use of the resources of our environment. *The Control of Organisms* tells the story of man's efforts to suppress or eliminate undesirable plants and animals. The central theme is that man must compete with many organisms which would destroy him or the materials he produces. In no sense is this a biology textbook, but it is rather a most readable account of man's fight against certain organisms of his environment.

The volume is recommended as a source book and for supplementary reading for biology survey courses in college and for high school biology courses, and as interesting reading for laymen as well as for all science teachers—elementary, junior high school, secondary school, or college.

The author is a professor of biological science at Teachers College, Columbia University, an ecologist of note, and the author of several research papers both in ecology and in certain aspects of science teaching. To this work, he brings his rich experience both as a research man and as a teacher directly interested in classroom problems in science.

—C.M.P.

KENDALL, JAMES. *Young Chemists and Great Discoveries.* New York: D. Appleton-Century Company, 1939. 272 p. $2.75.

In this day and time when the public is so aware of chemistry at work and teachers are earnestly stimulating their pupils toward vocational goals, such a book as this finds a welcome place in the home and in the school room. The book describes the early life and struggles of brilliant young chemists and shows how their work has influenced the development of chemistry and closes with the note that there is still room for more youthful research. The idea behind the book resulted from the Royal Institute Christmas Lectures, 1938–1939. We may read of Sir Humphrey Davy, an apothecary apprentice, becoming director of the Royal Institution Laboratory at the age of twenty-two, and how Michael Faraday, a bookseller's apprentice, was appointed assistant in the same famous laboratory. We read of Perkin and Kekule, young organic chemists; of Louis Pasteur and Arrhenius; of Madame Curie and her daughter; of young American chemists like Robert Hare, who invented the oxyhydrogen blowpipe; Charles Martin Hall, who at the age of twenty-two, with home-made apparatus, gave to the world a method of extracting aluminum; and Irving Langmuir. Dr. Kimball, himself as a young chemist, enjoyed the hospitality of the United States, teaching and doing research work in New York City. The book includes some of his own reminiscences.

—Greta Oppe.

ANONYMOUS. *Environment and Conflict.* American Geographical Society, New York, 1939. 25 p. $1.00.

Although prepared for Fellows of the Society, this publication entitled "Environment and Conflict in Europe," is available to the public. Intended for general reference purposes and for use in following military movements, the maps make clear many essential facts concerning the European situation in its political, economic, and strategic aspects. There are eighteen colored maps on a large sheet showing much important information that would be extremely difficult to assemble. The maps are accompanied by a pamphlet containing explanatory text, a list of sources used, an index of some 2300 names appearing on the maps, and a special map of Finland and its neighboring regions.

—Greta Oppe.

ALLEN, R. M. *The Microscope.* New York: D. Van Nostrand Company, Inc., 1940. 286 p. $3.00.

This book explains practical microscopy and microtechnique. It demonstrates each type of microscope and all accessories and describes the methods and techniques of mounting specimens. The bibliography, plates, and glossary are excellent. It is the author's hope that this book will

supply information not available in any other single volume; that it will aid in improving techniques for users of the microscope and in stimplating those who wish to follow this fascinating work either as a vocation or a hobby.

The contents of the book includes an historical introduction, an explanation of optical principles, a description of modern instruments, a discussion of illumination, testing devices and their value as well as their care and manipulation. The basic principles of the microscope and slide making, stains, and chemical reagents find adequate treatment by the author. The book will be a valuable asset wherever microscopes are in use.

—Greta Oppe.

LEMAY, GERALDINE. *The Story of a Dam.* New York: Longmans-Green and Company, 1940. 68 p. $1.50.

Here is a story of the Norris Dam from the time engineers made their preliminary surveys until the time farmers were using electricity produced at the dam. The photographs are the outstanding feature of the book. They were produced by the Tennessee Valley Authority. The narrative of the story closely follows the illustrations, which are arranged in sequential order.

This book would serve as useful source material for a junior high pupil studying a unit on conservation.

—Roy V. Maneval.

PERRY, JOSEPHINE. *Fish Production.* New York: Longmans-Green and Company, 1940. 104 p. $1.50.

Fish production, a highly important but little known phase of American industry, is outlined in this brief and simple story. It tells of the important food fishes, where they are caught, and the modern methods of catching and marketing them. Methods of fishing, such as line fishing, otter trawling, purse seining, and pile traps, are clearly described and illustrated. The description of the special equipment used in lobster, crab, and oyster fishing is excellent. The care of nets and how the fisherman markets and preserves his fish is given.

The author emphasizes that the future of the industry depends on conservation. She points out that our federal and state governments are doing good work in promoting conservation in this, one of the oldest of American industries. This book can be used by upper elementary and junior high school pupils.

—Roy V. Maneval.

HANSON, S. E. G., AND WELLS, MARJORIE E. *Ponds, Pools, and Puddles.* Portland, Oregon: Binfords and Mort, 1940. 189 p. $1.50.

The purpose of the book is to introduce as simply as possible a number of common freshwater animals, and to give sufficient information about each of them for group identification. It should prove very useful both as an aid to the teacher in directing young people in a study of pond life and in interesting the young reader directly in this phrase of biology as a hobby. Great care has been taken to call attention to structural characteristics which differentiate forms that otherwise might be confused by the novice because of superficial resemblances. It is well illustrated with photographs. A page of selected reference material and a nine-page glossary are also provided.

—O. E. Underhill.

SANDERSON, IVAN T. *Animals Nobody Knows.* New York: The Viking Press, 1940. 76 p. $2.00.

Twenty-one delightful full page illustrations of little known animals. Facing each picture is a page of descriptive material. Among the animals described appear such names as the cobego, mara, pichiciago, babirusa, dil-dik, as well as some perhaps more familiar ones as the aye-aye, kinkajou, panda and bandicoot. They represent eleven of the twelve groups of mammals. The final page lists these twenty-one animals, grouped by families.

—O. E. Underhill.

BAER, MARIAN E. *Rain or Shine.* New York: Farrar and Rinehart, Inc., 1940. 292 p. $2.00.

Predicting the weather has become an important and fast growing science. Mariners, agriculturists, and airplane pilots have increased their demands on both private and federal forecasters. The study of meteorology is now a part of every pilot's training. Sports groups and moving picture studios rely heavily on weather forecasts.

*Rain or Shine* describes the work of the weather man. It tells of the difficulties encountered by men in making observations. It describes the cycles of heat and cold, rain and shine; ocean currents and prevailing winds and what they do to climate. One section of the book tells of unusual weather, oddities of ocean currents, and erosion.

A book of this kind will help answer many weather questions of the student of the secondary school. It should find a place in many school libraries.

—Roy V. Maneval.

MCILHENNY, E. A. *The Autobiography of an Egret.* New York: Hastings House, 1939. 58 p. $2.00.

The life history of an inhabitant of the world famous bird sanctuary on Avery Island, Louisiana, is told in this interesting book. This autobiography describes the hatching of the egret egg, the details of the young egret's training period, its home in Bird City, the annual flight to the tropical areas of South America and the return to Avery Island, mating and the selection of a home site, and the care of the young family.

The forty excellent photographic illustrations

show up to good advantage because of the high quality of the paper of the book. They fit into the narrative admirably, and by themselves almost tell the life history of an egret.

Formerly filigree plumes from the egret often decorated the hats of ladies. Today, thanks to the efforts of the author of this book, the birds are protected in certain areas, and through his efforts much is being done to conserve the wild life of America.

Every nature lover will enjoy reading this book. Due to its simple language, it will appeal to many children. —Roy V. Maneval.

CHACE, LYNWOOD M. *Look at Life!* New York: Alfred A. Knopf, Inc., 1940. 225 p. $3.50.

A study of this collection of nature photographs impresses one with the skill of the person who produced such excellent pictures. The book is divided into four sections: Fur and Four Legs, Birds All, Cold-Blooded Ones, and Monstrous and Mysterious. Each photograph is accompanied by a short paragraph which describes something of the life history of the insect, bird, or animal.

This book will assist teachers of biology and nature study in making their subject more meaningful to their students. The excellent engraving and high quality of the paper aid in showing the excellence of the photographs. The collection consists of 187 half-page and full-page photographs.

—Roy V. Maneval.

SYMPOSIUM. *Popular Science Talks. Volume XII, Volume XIII.* Philadelphia: The Philadelphia College of Pharmacy and Science, 1938, 1939. 198 p., 241 p. $1.00 each.

These inexpensive paper bound volumes contain lectures given by members of the faculty of the Philadelphia College of Pharmacy and Science. Besides giving much concise information about the scientific phases of everyday life in a way that everyone can understand, such books would give valuable help to those teachers and students who are called upon to give talks before civic clubs, church groups, and similar organizations. Sets of the lecture volumes are available and would be valuable additions to any school or public library.

The lectures of Volume XII are "The Herbs and the Stars," "Conquest of the Planet Earth," "Living Light," "Tooth Truths," "Free Air," "Famous Finds by Pharmacists," "The History and Romance of Microscopy," and "Silver, Metal of the World." Volume XIII contains "Blood and the Criminal," "Sea—Inside," "Milestones in Chemistry," "The History and Romance of Digitalis," "Elements of Flight," "National and International Standards for Medicines," "The Drugs of the Bible," "Building Castles of Health," "Out of the Trash Can," "Out of Another Trash Can," "Streamlines," and "The Age of Obesity."

—Roy V. Maneval.

DEVOE, ALAN. *Down to Earth.* New York: Coward-McCann, Inc., 1940. 228 p. $2.50.

Mother Earth seems more intimate after reading a book such as this. The author, a naturalist, describes his observations of worms, cats, butterflies, skunks, oysters, birds, snakes, and bats in a most interesting manner. The philosophy of this nature-lover is brought out in his chapters on "The Overcivilized," "Men Against the Trees," "Health," "On Awakening," "Small Things," "About a Symbol," "Of Shapes and Sizes," "Our Living Past," and "The Brave Men of Brielle."

This book consists of essays, many of which have been published before in various magazines. It is for that reader who wishes to know more of the natural history of the everyday countryside. A number of technical and pictorial illustrations make the book more meaningful.

—Roy V. Maneval.

WHEELER, HAROLD, General Editor. *Marvels of the Modern World.* New York: Halcyon House, 1940. 448 p. $1.98.

Man's achievement during the last century is shown in this comprehensive and fascinating encyclopedia. Developments in modern transportation are fully described and illustrated. Engineering feats, such as construction of tunnels, bridges, and dams, are included. The development of modern chemistry is covered in a chapter called "Wooden Stockings and Milk Clothes." One section of the book gives the development of telephone, radio, television, and photography. Telescopes, stratosphere flights, the oil industry, and many other subjects are covered in this informative volume.

This book is well illustrated by over 400 photographs. It would be an excellent reference book for any science classroom.

—Roy V. Maneval.

GANN, ERNEST K. *Sky Roads.* New York: Thomas Y. Crowell Company, 1940. 123 p. $2.00.

*Sky Roads* is exciting adventure in the air with Ernest Gann, a pilot of the American Airlines who loves to fly and knows flying from beginning to end and tells about it in his book. It is full of photographs and his own drawings, too, for he is also an artist.

All the questions a boy wants to know—a grown-up, too, he has put into his book with something of his own personality. He tells about the early days of flying and the legend of "Jenny," the starting point in American aviation, formally known as a Curtis JN4-D, built in great haste for our budding World War I air corps; the "Tin Goose" or Ford tri-motored plane, dear to the hearts of early commercial pilots and unequalled for carrying heavy loads out of small fields, still in use today in jungle airports with loads of mahogany, faithfully

carrying on the tradition of a great airplane, concluding the story of aviation with the huge monsters of today.

But the most interesting and most important part of the book tells about the actual job of flying. What makes an airplane fly? What is the Air Speed and the Altimeter? How can we fly blind? and many other questions placing responsibility on the pilot. By means of drawings and careful explanation you travel through the complete layout of the interior of a plane; you study the weather and study the work of the skilled meteorologists who tell how and when and where to fly.

We may have good weather and a magnificent plane but in the end we must have airmen. Mr. Gann tries to tell what makes a good pilot and how one pilot can be much better than another. No one seems to know just what makes a good pilot. Even the learned flight surgeons are still delving into the subject.

His description of flight ten is as breath-taking and exciting as flight ten itself to New York. The book concludes with the prediction that although our domestic airlines are doing an outstanding job in our own country, it now looks as though much of our aerial future will lie in foreign skyways. "To knit the whole world in common progress, we must know each other well, and the airplane will make this possible. Science leads the way. Aviation will never grow old. It is a young man's game." In the words of Ernest Gann, "It's great."

—Greta Oppe.

BEN MEŸR, BERL. *Your Own True Story.* Caldwell, Idaho: The Caxton Printers, Ltd., 1940. 232 p. $3.00.

Berl ben Meÿr tells here the all-important story of the anatomy and physiology of the human body from the very beginning of life on earth. The human body is explained in all its functions.

The book is accurate but not too technical and the chapters are readable because the facts are presented in so engaging a manner.

The story of the author makes the book all the more remarkable, for Berl ben Meÿr came to America from Rumania, because higher education was denied or made difficult to Jews. The father, unfamiliar with American business methods, lost most of his capital within six months after arrival, causing his son to work before and after school hours. After leaving grade school, he read widely and attended night school when able. In eighteen months he secured equivalent credits to a four-year high school course. It was at Beth Israel Hospital that he landed a job in the laboratories and where his ability was recognized. He studied the basic medical subjects at the University of Maryland, but illness intervened and ben Meÿr was bedridden for many years. In the course of recovery he has done research work and much writing, including *"Your Gems and Mine"* or *The Story of Microbes.*

With such a background, it is amazing how clearly and simply he succeeds in making clear to the reader the fascinating mysteries of growth and life.

—Greta Oppe.

BORER, M. CATHCART. *Mankind in the Making.* New York: Frederick Warne and Company, 1939. 152 p. $1.50.

*Mankind in the Making* explains in a clear and fascinating manner with delightfully colored illustrations the history of the past and the work of scientists in arriving at a correct knowledge of and an appreciation of past civilizations.

The title of the book is so compelling and so thought-provoking and stimulating that it seems a pity to give so much emphasis to the gibbon, orang-outan, and chimpanzee as the "ancestors of man"; and to place on the opening page another chimpanzee for the "beginning of things." The author himself writes: "It is not correct to say that we are descended from the anthropoid apes. The evolution of man is more complicated than that"; but in view of the illustrations pictured there, the average lay reader or young reader would carry away a different interpretation.

—Greta Oppe.

DUPUY, WM. ATHERTON. *Our Bird Friends and Foes.* Philadelphia: The John C. Winston Company, 1940. 328 p. $0.80.

This popular book like its companion piece, *Our Animal Friends and Foes,* takes the reader into birdland and shows him the routine of bird life with just enough scientific background to make the stories informative and fulfill all the requirements of nature study teaching. Such a book as this can help to win public sentiment to appreciate bird and animal life in the animal kingdom. Through his stories their helpfulness and destructiveness are strongly brought out. The book includes many familiar feathered friends as well as birds not often found in supplementary readers such as the heron and the stork, the chicken and the duck, the sea gull and the penguin.

The drawings used throughout this series were made especially for it. At least one full-page illustration in color appears in each volume.

—Greta Oppe.

DUPUY, WM. ATHERTON. *Our Animal Friends and Foes.* Philadelphia: The John C. Winston Company, 1940. 285 p. $0.80.

Animals occupy a place of primary interest among adults as well as children. In this popular book Mr. Dupuy has succeeded in giving us accurate information about animals as well as genuine entertainment. Such a book ought to have a wide circulation because the information is dependable. The author has taken unusual care to make certain that his stories about these

animals are scientifically accurate by having them checked by government authority. The animals described range from the garden slug and frog to rattlesnakes and grizzly bears.

Odd bits of information about them which have been found useful make the book all the more interesting reading; for example, the garden slug as a gas detector. Such a book supplies all the requirements of nature study teaching.

—Greta Oppe.

VERRILL, A. HYATT. *Wonder Creatures of the Sea.* New York: D. Appleton-Century Company, 1940. 272 p. $3.00.

Mr. Verrill writes with a vivid pen when he describes the "wonder creatures of the sea." The many illuminating line drawings and photographs by the author add to the appeal and interest of this fascinating book. Not only does he describe the wonderful and amazing denizens of the deep as well as of the tide pools, but he tells their strange habits and explains the commercial, economic, and geological importance of sea creatures in a manner that will make anyone want to explore the shores and shallow waters. To add to popular knowledge of marine animals and plants is the real purpose of this entertaining and instructive book. The contents of the book includes animals that appear to be plants, life in a tide pool, creatures that dwell in tunnels, skeletons that keep us clean, cousins of the corals, a visit to a coral reef, shrimp, lobsters and their kin, and creatures of the deep sea. Mr. Verrill's books are always welcome additions to any library.

—Greta Oppe.

SMITH, B. WEBSTER. *The World Under the Sea.* New York: D. Appleton-Century Company, 1940. 230 p. $3.00.

Here is a book, popular and concise enough, to arouse a lively concern in the marine world where, as the author writes, "is no peace and no security." The book fills a real need for that reader who is interested in oceanographical exploration but who has not the opportunity or the desire to study specialized publications on this vast subject. The author is a member of the Marine Biological Association of Great Britain. It sets before the reader a plain and straightforward account of ocean phenomena, followed by a brief, general survey of marine life. The contents includes marine reptiles, mammals and birds, deep sea fishes as well as common food fish, sea lilies and their kin, corals and marine crustaceans, sponges, marine plants, ocean currents and tides, the physics of the sea and a discussion of our knowledge of the ocean and whence it comes. The book is profusely illustrated which makes it so valuable to the lay reader. The book closes on a conservation note thus: "The harvest of the sea is bountiful, but it is not limitless; reap it sparingly and wisely."

—Greta Oppe.

MORGAN, ALFRED. *Things a Boy Can Do With Chemistry.* New York: D. Appleton-Century Company, 1940. 288 p. $2.50.

Alfred P. Morgan is well equipped to write books on science for the layman. As an electrical engineer, his achievements include many valuable contributions to the development of the radio. He knows how to combine this technical skill with practical knowledge in a manner that boys and girls will welcome. There are more than one hundred experiments to perform and an abundance of text material to show what chemistry is, what the tools of the chemist are, and what chemistry is doing in this modern world. Teachers, too, will welcome such a book as this for it is practical, and even a prosaic experiment becomes exciting under Mr. Morgan's directions.

—Greta Oppe.

DAVIS, WATSON. *Science Picture Parade.* New York: Duell, Sloan and Pearce, 1940. 321 p. $3.00.

A Watson Davis book is always welcome. This *Science Picture Parade* lives up to its title by presenting several hundred most excellent photographs which have appeared on the cover and in the pages of *Science News Letter.* Each illustration is accompanied by a few lines of interesting and pertinent information. The pictures are grouped under twenty-two heads such as "Animals," "Atoms, "Chemistry," "Earth," "Light," "Machines," "Stars" and "Weather." Each section opens with a few pages of unifying material.

—O. E. Underhill.